IMPROVED DOUBLE CYLINDER MARINE ENGINE.

BY GEO. FORRESTER & Co. LIVERPOOL, INVENTED BY BENJn. HICK, FOR THE HELEN MAC GREGOR.

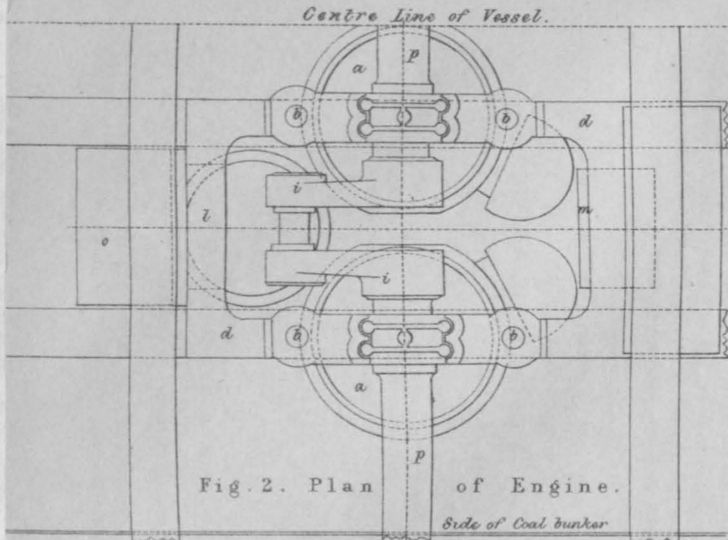
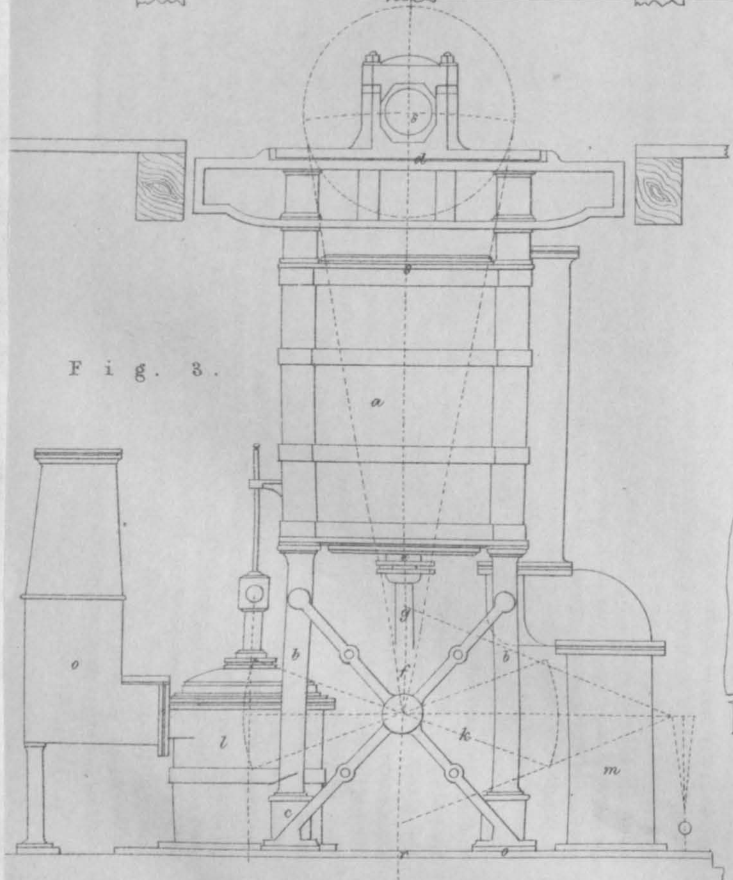


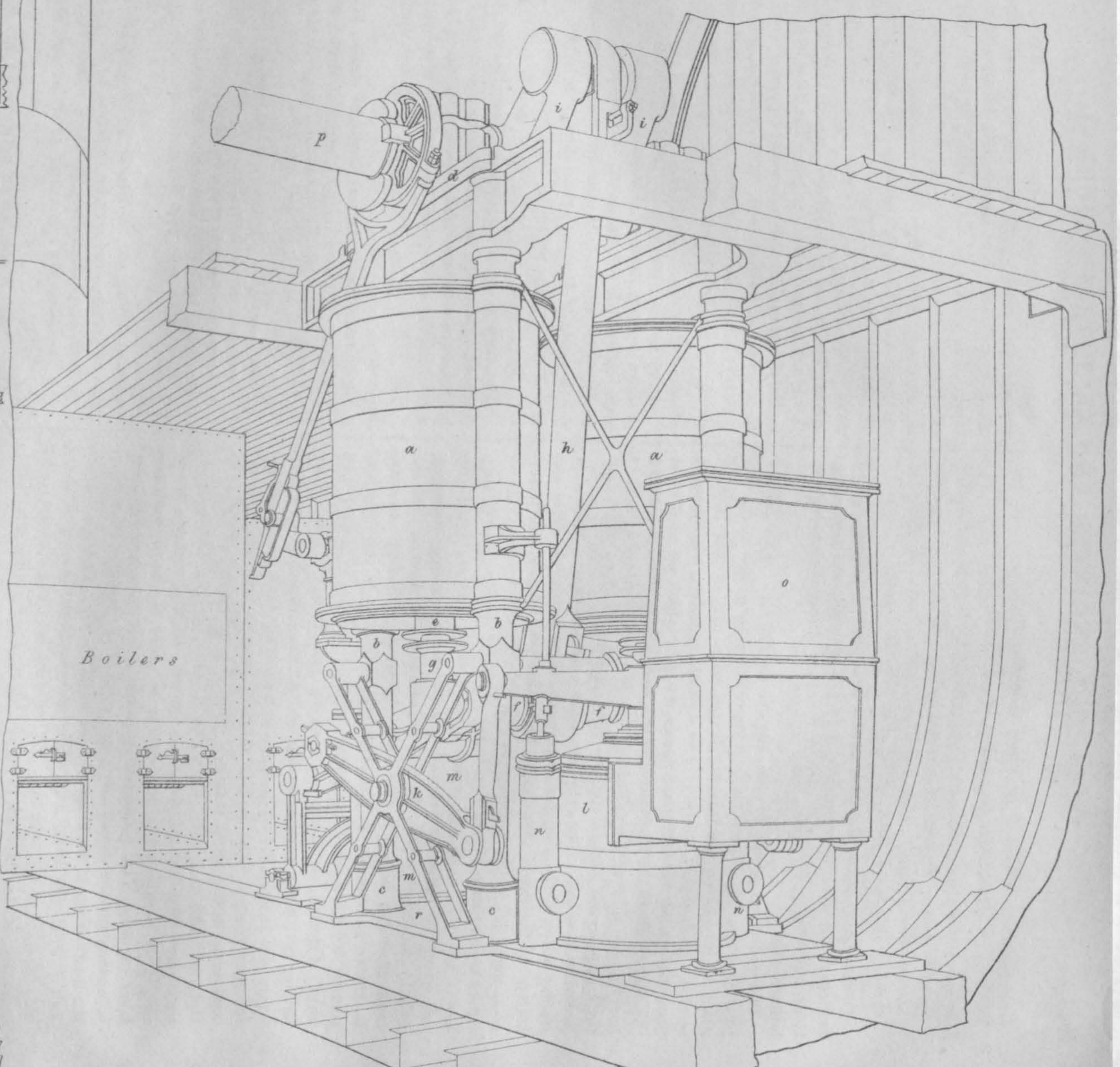
Fig. 2. Plan of Engine.

Fig. 3.



Side Elevation.

Fig. 1.



DIRECT ACTION ENGINES.

(With an Engraving, Plate XIII.)

Description of a pair of GEORGE FORRESTER & CO.'s *improved Double Cylinder Marine Engines, constructed by them, and fitted on board the "Helen Mac Gregor," Hull and Hamburgh steamer. Engines invented by* BENJAMIN HICK, *of the above firm, Liverpool.*

These engines are of the form usually denominated "Direct Action Engines," but differing considerably in arrangement, and possessing many advantages over the various forms of direct action engines hitherto made.

The collective power of the engines is 220 H.P. The accompanying engraving represents a perspective view of one of the engines when looking towards the boiler, with part of the boat in section. Each engine consists of two inverted cylinders, *a a*, mounted upon four strong wrought iron columns, *b b*, &c., which are secured at the lower ends to the foundation plate *c*, and passing through suitable boxes on the sides of the cylinders, and secured by means of nuts at their upper ends immediately to the entablature plate and crank pedestals, *d*, above. The cylinders stand "athwart ships" with their stuffing boxes, *e e*, looking downwards, and at such a height from the bottom of the vessel as to allow the main cross bar, *f f*, which connects together the two piston rods, *g g*, to work the full length of its stroke below them: the stuffing boxes are made double; that is, they have a space for packing, both top and bottom, and are fitted with self-acting oil cups for lubricating the rods: *h*, is a long connecting rod, by means of which the power is transmitted directly from the main cross bar below, to the crank, *i*, above the cylinders. In order to ensure an equable action of the two piston rods and their connecting cross bar, they are further secured and made to work uniformly together, by means of a strong cast iron vibrating frame forming part of the parallel motion, and which, with side levers, K K, serves also to work the air-pump, *l*, as well as the feed pump, *n*, bilge and brine pumps. The paddle shafts, *p*, wheels, and bearings, are constructed in the usual manner. The slide valves are of the usual, D, form. The condenser, *m*, is placed immediately underneath the slide valve case, and the air pump, foot and discharge valves, are arranged as shown, being very similar to those of the ordinary side lever engines. The connection between the air pump and condenser is underneath the foundation plate, *r*; *o*, is the hot-well from which the waste water is discharged by an overflow pipe through the vessel's side in the usual way. The cross forming the support of the side levers is of wrought iron. When working, these engines are remarkably steady, there not being the slightest perceptible tendency to motion in any part of the framing. It is well known that in all reciprocating engines, of whatever form or construction, the *parts of the engine subject to the greatest strain, are those which lie between the point at which the cylinder is secured, and the centre of the crank shaft, to which the power of the engine is communicated*; hence in this engine, the only portion of the framing through which the power of the engine is transmitted, is from *s* to *s*, and there is no other part of the engine framing whatever subject to the strain of its power, except *the short space intervening these two points*. The elevated position of the cylinders also secures them from liability to *water from the boilers*, as they are at a higher level than the water line; and accidents from the above cause (to which marine engines are frequently subject) cannot occur. The space occupied by the cylinders is so much above the engine house floor, that there is considerable more space below than in the ordinary engine, to get round about the working parts, which are all below, and occupy a comparatively small space underneath each set of cylinders; both the upper and lower covers of the cylinders are removable, and by taking off the upper ones only, there is clear room (without the intervention of the piston rods) to examine and clean the pistons, or adjust them, without disturbing the stuffing boxes below, or uncoupling any further part of the engine. The position of the *condenser* and air pump is such, as to render them accessible on all sides, and the condensers being directly below the slide valves, the exhaustion is rendered more immediate and perfect, by its proximity to the openings of the cylinders. The *connecting rods* are necessarily of *great length*, and the strain and consequent friction to which engines with short connecting rods are subject, is thereby overcome. The motion of the air pump, as in the side lever engines, is effected *upwards* whilst the pistons are descending, and the weight of the air pump, bucket, cross head, &c., counterbalance that of the connecting rod and its appertenances. There is a clear passage between the engines, below the cylinders, on the engine floor, and from this point all the working parts of the engines are within reach of the engineer. The *saving of weight and space* is very great as compared with that of the ordinary marine engine. The total length of room occupied by the above engines and boilers and 60 tons of coal, is only 34 ft. 6 in. from bulkhead to bulkhead. The centre of gravity of engines and boilers is not higher than that of the ordinary marine engines, and the saving of weight renders that of engines, boilers, and boat considerably lower.

It may be observed, that in principle of action there is nothing new in these engines, steam of 5 lb. pressure is used in the boiler, and the slide valves cut off steam at three-fourths of the stroke. The novelty consists merely in using *two inverted cylinders*, and in the particular mode of disposing the different parts, and so arranging them, as to confine all the requisites for a more effective and durable engine with the greatest possible saving of weight and space.

The boilers are of the tubular form, and are the first of the kind made at Liverpool; they generate an abundance of steam, and have brine pumps attached. An apparatus is fitted to each fire-place for consuming the smoke, upon the principle of admitting heated air.

The following are some of the principal dimensions, &c., of the engines:—

Cylinders, 42 in. diameter; length of stroke, 4 ft. 6 in.
Air pump, 33½ in. diameter; length of stroke, 2 ft. 4½ in.
Capacity of condenser, including passage to air pump, 44 cubic ft.; ditto of hot well, 36 cubic ft.
Wheel, 23 ft. 6 in. diameter, to the outside of floats.
Number of revolutions, 23½.
Pressure of steam in cylinder, 3¾ lb.

The vessel is of iron, and one of the strongest hitherto constructed. She is divided into five compartments by strong water-tight bulkheads; her speed by the log during a late trial trip, was 12 knots, (engines making 23 revolutions per minute,) and having 200 tons of coals and cargo, dead weight, on board.

Dimensions, extreme length, 175 ft.; breadth, 25 ft.; depth, 16 ft.; burthen, 573 tons; draft of water with 400 tons dead weight, 11 ft.

This vessel is the last of between 50 and 60 built by Mr. John Laird, who, we are happy to hear, has now on the stocks an iron frigate of 1400 tons for Her Majesty's service, as well as several for the Honourable East India Company, and other parties.

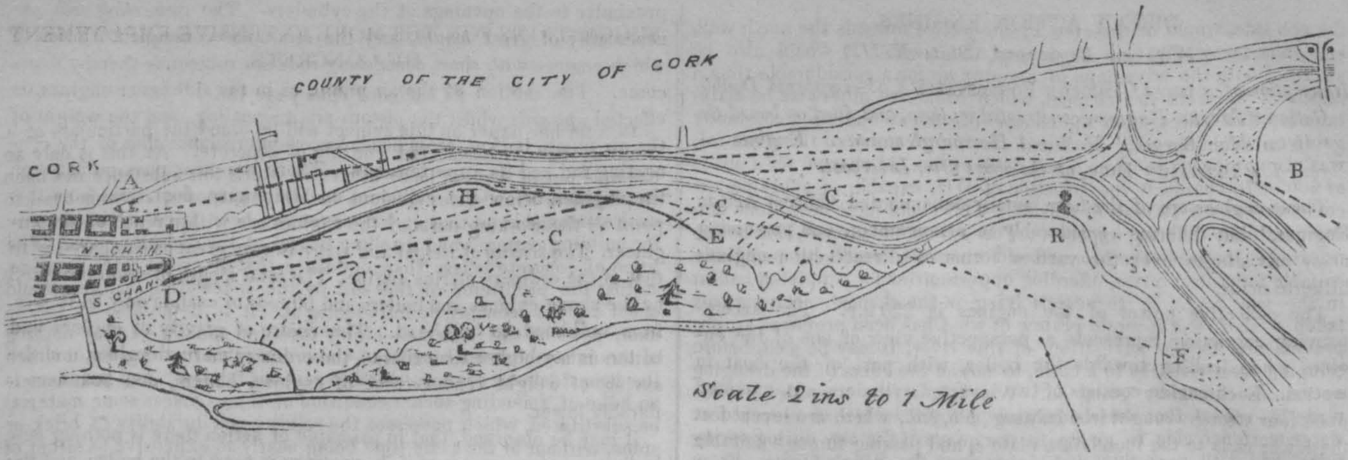
REMARKS UPON THE PRESENT STATE OF THE HARBOUR OF CORK AND THE RIVER LEE.

COMMUNICATED BY GEORGE WHITE, A.I.C.E., &c.

THE eligibility of Cork as a harbour is so generally known, that it would be superfluous, on the present occasion, to dwell at any length upon its merits. It may not, however, prove uninteresting to take a short notice of its capabilities as a place of refuge. Considering the spaciousness, security, and other advantages which this harbour possesses, it appears difficult to account why Waterford should have received such favour in the late inquiry before a select committee of the House of Commons, instituted for the purpose of determining the most proper station for a mail communication with the south of Ireland,[1] the latter being, as is well known, a bar harbour, having only ten feet water over it at low spring ebbs, besides other disadvantages, with which nautical men are well acquainted.

Cork is the only place on the south coast of Ireland fit to accommodate ships of the line, with the exception of Bantry Bay. There are, perhaps, few natural harbours so perfectly devoid of danger; the

[1] See Evidence of William Preston White, Esq., Harbour-master, in the Parliamentary Reports of 1842.



A B, part of proposed line of railway from Cork to Cove. D H, old part of navigation wall, commenced in 1761. H E, new part of navigation wall, built about 1835. CCCC, proposed jetties for sluicing. ---- Dotted lines denote the direction of the proposed new channel. R, Black-rock Castle. B, Sun Lodge.

only obstruction of any note (if such it can be called) is the Harbour Rock, which is a pinnacle of such small dimensions as to be easily removed by blasting: accidents are, however, of such very rare occurrence, as to render such a precaution unnecessary. The soundings outside the mouth of this harbour are so regular, as to enable ships to run for it in thick or foggy weather by using the lead, an advantage which Waterford does not possess, the entrance being very rocky, and the soundings consequently irregular. The accommodation which Cork is capable of affording is great beyond conception, as many as 500 sail of vessels having frequently enjoyed its shelter. Its storehouses are on an extensive scale, occupying the greater portion of the Island of Haulboluie. The most interesting part of the subject, however, in an engineering point of view, is the river, which it may be advisable to pass on to, rather than dwell upon the advantages which nature has so lavishly bestowed on this harbour.

The River Lee, the subject of the present memoir, rises on the confines of an adjoining county (that of Kerry), at a considerable distance from Cork. It does not, however, become of sufficient importance to be considered in connexion with the navigation until it approaches a large weir within a mile of the city, which has been erected for the purpose of damming up the river, the town being supplied with water from this place, which, as may be expected, has the effect of doing the navigation considerable injury. The river is here divided into two branches, which do not again unite until they reach the Custom House, a part of which is marked on the accompanying plan, D. Before proceeding to describe what has been effected in the deepening of the channel by the dredging operations constantly going on, it may be useful to take a cursory glance of the various proposals which were made to improve the navigation. The first attempt worthy of note appears to be the building of an embankment or wall, marked D H, for which the Irish parliament advanced £4000 in 1761. It was erected for the purpose of confining the flood waters of the Lee, and in this way it was expected to keep the river from filling up. However well it may have preserved that portion of the channel along which it was formed, it appears to have done so at the expense of other parts, for large deposits of mud were constantly taking place below it; and the navigation was becoming so much obstructed from shoals, that it was found necessary to consult Mr. Alexander Nimmo, and to invite him to report upon the best means of remedying the increasing evils. Accordingly we find this eminent engineer, in 1815, complying with this request by making a most elaborate survey of the river, accompanied with a report.

The principal works suggested by him appear to have consisted in forming a still-water navigation, one end of which was to have terminated in the deep water of Lough Mahon, below Black-rock Castle; the other at some waste land near the Custom House, which he proposed forming into wet docks, for which purpose the locality appeared to offer peculiar advantages. The expense of such an undertaking (about £160,000) at a time when the funds of the corporation were by no means great, was most probably the cause of this proposition not being adopted. It has not been marked on the accompanying sketch, fearing that it might have become confused from the smallness of the scale. It was likewise intended that the present channel should have been deepened by dredging so as to admit vessels of greater burthen to come to the quays. He was also of opinion that the building of an embankment at the north side of the channel, where it bends towards the King's Quay, would have been most beneficial. The position of this wall would be well represented by supposing the present embankment, HE, removed to the other side of the channel. There can be no doubt that such a work would have been most advantageous to the navigation, as the current on the ebb setting in the direction of this embankment would have the effect of materially deepening the channel. It would also afford an opportunity of reclaiming nearly 200 acres of waste slab, which, from its proximity to the city, would, in course of time, become valuable property, and handsomely repay the expenses incurred. From its running parallel and close to the channel, vessels could have used it as a towing-path until they came up as far as the old wall, DH. It is much to be regretted that Mr. Nimmo's recommendation in this particular was not followed: expense in the present case cannot be pleaded as an excuse, as we find the harbour commissioners building such an embankment, HE, but unfortunately at the wrong side of the channel. It would require no very great amount of foresight to perceive that the erection of such a work in such a situation would have been attended with the most injurious consequences to the navigation. This does not appear, however, to have occurred to the Cork Harbour commissioners; for a line of railway from Cork to Passage being then in contemplation, we find them proposing to continue this wall for the purpose of carrying the railway over it; the projectors of which, it would appear, considered the railway of much more importance that the navigation of the river. The scheme, however, not succeeding, the wall was not finished, and in this condition it now remains, a monument of disgrace to its projectors.

About the same time a railway was proposed from Cork to Cove, a part of which is marked AB on the plan. The promoters of this speculation appear to have had the improvement of the river more at heart, for we find in the report a plan proposed for the improvement of the navigation by Mr. M'Neil, in which the subject is treated with his usual ability. The principal improvements consisted in cutting a new channel, as represented by the parallel dotted lines, from the Custom House to Black-rock Castle; this would be nearly a straight line; and it was intended that the embankment for the railway should have formed a great portion of its northern boundary, to which might have been added a towing-path for the accommodation of vessels. It may be well to premise that this new channel was to be cut entirely through the slab, which consisted of a material well suited for filling up the embankment. The works were thus to be carried out in concert, each being made subservient to the other, and the expense would have necessarily become in this way very much reduced. The part of the wall represented as being cut in two places by the new channel, and which it would have been necessary to remove, would have gone towards forming a barrier at H. The northern boundary of the channel would, under this arrangement, have been well defined. At the south side it will be seen that there is a great extent of slab, probably from 300 to 400 acres in extent, over which the tide ebbs and flows twice in every 24 hours. This vast body of water, which may be regarded as the possession of a power of great value, was proposed to be usefully employed by scouring the channel: this was to be effected by building jetties (marked CCC, &c., on the plan), over which the water was to flow at every half tide, which, returning on the ebb tide, would be directed by the jetties towards the north wall, and thus materially tend to deepen the river. It would also be attended with the advantage of keeping up for a considerable time a depth of water in the channel, which could not otherwise be maintained. The effect upon the channel of such an operation constantly going on would speedily be felt in the improvement of the river. It was also proposed to make a wet dock of the old channel for a space of 600 or 700 yards, in the direction of D H, capable of affording accommodation for 100 sail of vessels. This could have been done at a comparatively trifling expense. The space of ground, H, before referred to, between the new and old channels, would be peculiarly suitable for ballast quays, affording opportunities for supplying ballast in the wet docks, or to vessels lying in the channel. Having now taken a short but accurate review of what has been proposed as improvements for the navigation of this river, it may be well, before bringing these remarks to a close, to notice the effect of the dredging operations constantly going on. We find, at the time Mr. Nimmo made his report, that vessels drawing more than ten or eleven feet water were not able to go up to the quays of the city during spring tides, and with neap tides not higher than the King's Quay. From constant dredging the bed of the channel has been very much deepened, for vessels drawing eighteen feet water are now enabled to come up to the quay during ordinary springs in one tide, which they were before unable to do in consequence of being obliged to wait below the Flats (a shallow some distance from the Meelagh Bank), until nearly the top of high water, the consequence of which was that, by the time they arrived near the King's Quay, the tide was too low for them to proceed further, and were consequently obliged to wait until next tide, a circumstance in many cases attended with no small inconvenience. A channel having been now cut through the Flats, this inconvenience has, in a great measure, been remedied. These have always been considered as the most formidable obstacle to the improvement of the navigation. The channel, since it has been cut, has at this place undergone very little change, which is so far encouraging. The dredge-boats are at present employed in cutting off an angle of the Meelagh Bank which projects much into the channel: when this is accomplished, the greater part of the impediments to the navigation below Black-rock Castle may be said to be removed. The straightening of the channel as far as practicable has been at all times a desideratum. The most obstinate shoal in the river above Black-rock Castle is in a part of the channel a little below the end of the embankment, H E, before referred to: this it has been found necessary to dredge away several times since the building of the wall; and it is probable, from its so quickly accumulating, that it would before long become a field of corn, were it not for dredging, which will, as long as the wall remains, be continually necessary, as the cause must be removed before the effect can cease.

The slab behind the embankment, DHE, is, as may be expected, constantly filling up with mud, which is occasionally again dislodged after heavy rains, and deposited in the channel. It will be evident, from what has been already said, that dredging can never be entirely dispensed with in this river under existing circumstances.

The commissioners do not appear to exert themselves in this matter as much as they ought, probably owing to the fact, that a portion of the material raised is very suitable for ballast, which, being in great demand, pays a great portion of the expenses incurred in raising it. From the returns made by the Ballast Office it appears that from 17,000 to 18,000 tons of this river clearance is annually supplied to vessels leaving the port, which is paid for at the rate of a shilling per ton, leaving a clear profit, after paying dredging, lighterage, and other expenses, of about sixpence per ton.

The quantity of material which the boats on this river are capable of raising is very variable, being entirely dependent on the nature and depth of the cutting, it being possible to raise a much greater quantity of gravel than clay in the same time. The largest boat, which is about 16-horse power, has raised as much as 60 tons of mud and gravel in 26 minutes; this, however, must be considered as a maximum, and worked under the most favourable circumstances. The average expense of dredging may be estimated at from 2½*d.* to 3*d.* per ton.

Hoping these remarks have not been extended to too great a length, we must now bring them to a conclusion: before doing so, however, we cannot help remarking that, had the various sums expended from time to time (in building embankments and other useless works) been judiciously spent under competent advice, the necessity of dredging would most probably be altogether done away with after the channel had been once formed. On few rivers has so much been done by nature, and so little by art.

SUGGESTIONS FOR THE MORE EXTENSIVE EMPLOYMENT OF CONCRETE.

(Concluded from page 158.)

In a former paper on this subject will be found the particulars of a dwelling house constructed entirely of concrete. As this is only an example out of a great many others in which this substance has been employed in France, for general building purposes, it cannot fail to excite astonishment that it has never yet been tried in this country for building cottages and dwelling houses of the humbler class. The price of concrete is less than one-third that of either brick or stone, so that the proprietor of the soil or the speculating builder would effect a great economy by introducing it. It is deplorable to see in many parts of this rich and highly favoured country—to say nothing of the unhappy sister kingdom—those miserable mud hovels in which the honest labourer is compelled to rear his family. And yet there is no hope of amending such a condition of things unless some material be substituted, which possesses the solidity and durability of brick or stone, without at the same time being nearly so expensive as either of these. Such a material is concrete with respect to the two former qualifications, while in point of expense it can probably be built at least as cheap as a good wall of mud. The construction of mud walls, in fact, although common in many of the northern counties, in Scotland and in Ireland, has never been practised amongst us with the same degree of skill, nor with the same success as in France, in southern Russia, and in many parts of Asia. In those countries the method of building *en pisè*, as it is called by the French, has been carried to considerable perfection, by skill in the tempering and puddling of the clay, and by mixing with it various ingredients, such as chopped straw, hair, &c., which increase its strength and cohesion. It is important to observe, however, that wherever building *en pisè* has been successfully practised, there has been the advantage of a nearly tropical sun to bake and indurate the newly formed walls. On the other hand, in this country, the walls of mud, however well formed, are subject to destructive atmospheric influence, before they can well be hardened, and it is therefore no wonder that they are far inferior to the *pisè* walls of warmer climates.

Concrete as a foundation for Roads.

The first account we have met with of the use of concrete for this purpose, occurs in Hughes' *Treatise on Roads.* [1] It appears to have been used by him on the Highgate archway road, under Mr. Telford's direction, as long ago as the year 1828. Mr. Hughes' practical experience on this subject is extremely valuable, as he tried on the same road another kind of concrete foundation, made of Roman cement and gravel, and although the latter is of course far more expensive, he decidedly gives the preference to lime concrete, owing to its greater toughness and its consequent capacity of resisting fracture. His proposal for the use of concrete in the roads round London is worth quoting, and we entirely agree in the propriety of it:—"I should recommend for all the principal roads round London—after all the supplies of water from the sides as well as that falling on the road have been properly intercepted by longitudinal side drains and transverse ones leading into them, and occurring as often as the nature of the subsoil may require—that a bed of lime concrete six inches in thickness, be laid all over the breadth of the road, and that this bed be afterwards covered with six inches of the best flint or pit gravel that can be procured, in two courses of three inches at a time; or with what in my opinion would be a much more lasting and serviceable material, four inches of broken granite stone: and I am convinced that a road so constructed, however bad the under stratum may be, will prove one of the hardest, most durable, and at the same time one of the cheapest roads ever formed in the neighbourhood of London."

Of late years concrete has been occasionally employed as a foundation for the street pavements of London, and in some few instances, road surveyors of more than ordinary intelligence, have introduced it into their practice with very great success. All those who have tried it for keeping down the subsoil of the London clay, have been highly gratified with its success, wherever the proper precautions have been taken to prevent traffic until the concrete has completely set. We have heard of one instance where a concrete foundation was laid down for a road near London, and a few inches of broken stone being placed on it, carriages were immediately allowed to pass over it. The wheels of these vehicles were actually in contact with the raw unhardened concrete, and it is scarcely to be wondered at that it wore into holes and became almost impassable. In this case the concrete was pronounced a failure; but it is scarcely necessary to observe how unfair were such a trial and such a condemnation. We could mention

[1] The Practice of making and repairing roads. London: Weale, 1838.

several other instances where considerable lengths of road, passing over the very worst descriptions of subsoil, have been successfully treated with a concrete foundation, which has ever since kept the clay from rising, and served more than any other contrivance could have done to keep the road in a sound and perfect condition. At the same time it is deplorable to witness the miserable and barbarous expedients which are resorted to, even at the present day, to form a foundation for the roads in the neighbourhood of London. It is generally known that the tough blue clay of the London basin, in common with the yellow plastic clays, on which the former rests, is one of the worst possible subsoils over which a road has ever to be formed, in consequence of its tendency to work up amongst the metalling. When the clay has thus become mixed with the metalling—whether consisting of gravel or broken stones—the most favourable condition for grinding down the crust of the road is at once realized, because the stones are separated from each other by a soft yielding matter, so easily squeezable and easily set in motion, that every pressure upon the road necessarily unsettles more or less the stability of part of the crust. The constant grinding of the stones against each other of course effects a destruction much more rapid than where the stones contain no more matter mixed up with them than just what is sufficient to fill up their interstices, and where this filling up matter is hard and firm instead of being soft and yielding, like the clay which has been spoken of. Few of the surveyors round London are ignorant of this troublesome property of clay, and they have in consequence commonly adopted some means which they have considered suitable for keeping the clay in its proper position beneath the metalling. For this purpose they have resorted at different times and different places to some one or other of the following expedients—large flat stones, broken bricks, bushes, or tin chippings. All these have been tried with various degrees of success, but with the exception of the broken bricks they are all either highly objectionable or perfectly useless. The flat stones become unevenly bedded in the clay, prevent the metalling from setting and binding, and cause the road to wear in a very irregular manner. The bushes are worse than useless, for they cause the road to be spongy and elastic while they continue to retain the least vestige of vegetable life, and when they decay and rot, the clay becomes kneaded and worked into them with the greatest facility. The tin chippings are of course well calculated, by the sharpness and hardness of their edges, for working and cutting into the clay, so that they actually do harm, and increase the evil they are designed to prevent. Of the several expedients, therefore, which have been mentioned, the broken bricks alone are entitled to any favourable attention. This substance being of a dry absorbent nature will in some degree correct the unctuous and slippery nature of the clay, tend to keep it at rest, and prevent it from working up so rapidly. It is evident, however, that this effect of broken bricks will be only temporary, for they cannot resist the repeated saturation of the clay, which must at length cause the latter to rise up through any thickness of broken bricks which may have been laid on. There are probably some of our readers who may be sceptical as to the employment of such a substance as bushes for the foundation of roads at the present day, and in the immediate neighbourhood of the metropolis. Such barbarous expedients, however, are by no means rare, and as an instance, we may mention the well known cemeteries on the south side of London at Norwood and Nunhead Hill. The approaches to these cemeteries and the paths made through them, have been executed according to the most approved system of bushing, as it is called; that is to say, upon a foundation composed of bushes covered over with a huge depth of clean sharp angular flints, without one particle of binding matter to unite them together. We need not say how much cheaper and more effectual it would have been to lay a concrete foundation, which might have been done for 1s. per square yard, and to cover it over with six inches of metalling about half the thickness which is laid on at present. When a concrete foundation has been once formed for a road, the subsoil is effectually cut off and for ever prevented from rising. Therefore it is of little consequence whether the top covering be rather clayey in its character, or whether it contain only just sufficient clayey admixture to make it bind well together. In the worst case, that is, where it contains too much clay, the latter will soon work through the stones up to the surface, and during wet weather may be scraped off in the shape of mud. Where the concrete, however, is not interposed between the subsoil and the metalling, all the labour that can be bestowed in selecting good materials and in reducing them to a clean state, is absolutely thrown away, for it will all be entirely counteracted by the rising of the subsoil, which it must be remembered is quite inexhaustible, and will continue to rise through successive layers of gravel or broken stone, however thick they may be. Even in the best macadamized roads in London there is more mischief done by the working up of the clay, and by the consequent grinding of the stones together than by any other cause. The grinding action on a soft subsoil, is at least double what it would be on a hard foundation of concrete.

MATERIALS PROPER FOR MAKING CONCRETE.

There is no part of the country which is destitute of materials fit for this purpose. Amongst them may be mentioned any kind of pit, river, or sea-side gravel, any kind of granite, sandstone, or limestone, broken bricks, fragments of pottery, oyster shells, and in fact every description of hard mineral substance. Should none of these be easily procurable, a very good substance for concrete may be made by burning clay in open heaps with any description of refuse coal. Clay burnt in this manner costs about 2*s*. 6*d*. to 3*s*. per cubic yard, measured in the heap when burnt, and will be found a very good substitute for stone, when the latter cannot be procured for making concrete.

Sand is an important ingredient which should never be neglected, but there are many substances which will answer equally well for mixing with the lime in concrete. Where sand, properly so called, is made use of, it should be clean, sharp, and not too fine, should feel gritty when rubbed on the palm of the hand, and should not soil the fingers, otherwise we may be sure it contains clay or loam, or some other substance which will injure the concrete. Amongst the substitutes for common sand may be mentioned the scales of iron, pounded iron ore after roasting, brick or tile dust, road drift, or pounded cinders. Any kind of clean sand may be used, whether from the sea shore, from pits, or from the beds of rivers. The Thames ballast, as commonly used for concrete in London, contains about the proper proportion of sand, namely, about one of sand to three or four of stones, conceiving all that to be sand which will pass through a sieve with wires one-eighth of an inch apart.

The varieties of lime, or what is the same thing, of the limestones which yield a lime proper for concrete or mortar, are so well known in this country, as not to require enumeration.

There is scarcely a locality in England where lime of some kind or other cannot be procured at the distance of a few miles; and although these limes are widely different in their quality, some being much purer and weaker than others, it may be taken as a general rule that the same quantity of sand which it would be proper to mix with the lime for making good mortar, will be just that same quantity which should be used with the same lime in making concrete. Thus the common white chalk lime, which if properly burnt—as it seldom is—will take 3 or 3½ sand, may be used with the same proportion in concrete, while the grey chalk lime should not be used with more than 2 or 2½ sand. The common chalk lime should never be used for concrete where it is subject to water or even to moisture in the ground; but the grey chalk lime may be used with perfect confidence in any situation, however damp. Specifications for concrete should always direct that the lime is to be ground into powder, otherwise it will not go nearly so far in the concrete, as innumerable small fragments will remain unslacked. This is of the highest importance, and should never be neglected, because no care, however great, bestowed upon the slacking, will so effectually bring out the virtue of the lime as when it is slacked in the state of powder.

The proportions which we would recommend for concrete in the neighbourhood of London, are the following:—

1 part by measure of pounded quick lime, burnt from the lower or grey chalk of Dorking, Merstham, or Halling.

2 to 2½ parts by measure of clean sharp sand, road drift, or other suitable material, as already described.

6 to 8 parts by measure of gravel or broken stones, &c., none larger than 2½ inches in its largest dimension.

Where the river gravel is used, and where it contains a sufficient quantity of sand, it may be mixed with lime in the proportion of one part of lime to 8 or 10 of gravel.

The best way to make the concrete for the foundation of a road, is to spread a stratum of gravel mixed with its proper proportion of sand to the depth of about six inches. This stratum should be formed across the road for the width of about four feet, and a covering of ground lime spread evenly over it about two-thirds of an inch in thickness. Three or four men should then turn the stratum of gravel and lime several times over, piling into heaps and again spreading it so as thoroughly to diffuse the lime. Lastly, it should be formed into a ridge about two feet high, and the water added only in sufficient quantity to mix with it by degrees, so as to form a thick stiff paste, in which every particle is just moist. In this state it should be spread and smoothed to the required depth, which for roads in the neighbourhood of London should be not less than six inches.

Underpinning Walls.

Concrete has been employed with great success by G. L. Taylor, Esq., Architect to the Admiralty, for underpinning walls of considerable extent. At Chatham the walls of a storehouse 540 feet in length were underpinned with concrete in about four months. The walls of this building had been founded about 40 years before on timber sleepers and planking, which had since decayed. It was necessary to excavate on each side of the walls to a depth of from 16 to 26 feet to take out the decayed timbers, which varied from 2 to 6 feet in height, and were 6 or 7 feet wide. The concrete was put in in a liquid mass to within a foot of the bottom of the old walls; at this level a large slate was bedded on the concrete, and the remaining foot was *pressed* in by an iron frame with two strong screws on each side of the wall. The concrete was placed in lengths of four feet, and the next day the weight of the superincumbent wall, 50 feet high and 5 feet thick, was allowed to come upon it, and no subsidence has ever been observed. In another building at Chatham which had settled about three inches, Mr. Taylor raised the part affected to its proper level, by forcing concrete under it in a similar manner.

Ranger's Concrete Stone.

Notwithstanding the failure of Ranger's patent cement stone when injudiciously used, it is said to have been successfully employed on several occasions. The Architect to the Admiralty, G. L. Taylor, Esq., has used it for building a school at Lee, on the model of the Propylæa at Athens.

In the concrete dock which was built at Chatham, Ranger's stone was used in the form of blocks for the bottom, but the sides were formed of concrete laid in mass and lined with granite. The expense of this dock is said to have been barely one-tenth of the amount which a dock built wholly of masonry would have cost.

The patent stone has also been partially employed at Woolwich in a river wall at the east end of the dockyard. This wall is 270 feet in length, 26 feet high, 7 feet broad at bottom, and four feet at top. The work was at first commenced on the plan of the concrete wall at Brighton, namely, by filling the concrete in mass behind a fence of boards placed in front of the face. Latterly, however, the face of the wall was formed of concrete blocks cast in boxes, with the massive concrete filled in behind as a backing.

Use of Béton by the French.

When béton was first introduced into France, it was made up in heaps and allowed to set. The heaps were then broken up, and the broken lumps of béton or concrete thrown into the foundation which they were intended to form. The following translation from Belidor explains the method in which the béton was prepared for the works of the Dock at Toulon.

"Having fixed upon a spot where the ground is firm and solid, take 12 parts of puzzolana and 6 parts of sharp sand free from earthy particles; having mixed these together, form them into a circular border about 6 feet in diameter. Then fill the interior with 9 parts of well burnt pounded quick lime, which is then to be quenched by adding water in small quantities. For maritime works sea water is to be used, and the lime is to be turned over from time to time to facilitate the process of quenching. When the lime has been thus reduced to a paste, the border of sand and puzzolana is to be incorporated with it. The whole being well mixed, throw into it 13 parts of broken stone or stone chippings and 3 parts of broken iron cinder or scoriæ. When this latter cannot be obtained, 16 parts of broken stone may be employed, or 16 parts of pebbles may be used, provided they do not exceed the size of a hen's egg. The whole composition must then be turned over and mixed together with shovels for about an hour, until every part is thoroughly incorporated, and then the mass is to be made up into small heaps. These heaps must remain untouched till they acquire sufficient consistency to render a pickaxe necessary to break them up. The time occupied in acquiring this consistency will be 24 hours in the summer in warm countries, and in winter time about three or four days. The heaps should be covered to protect them from rain."

Speaking of béton formed in this way, a writer in the French *Encyclopædie Méthodique*, states that by way of experiment, a box containing 27 feet cube was filled with it and plunged into the sea, where it remained for two months. When taken up the cohesion of the heap was so great, that it was more difficult to break up than a block of the best stone.

ON WARMING AND VENTILATION.

The objects proposed to be accomplished by the different methods of warming apartments, namely, those of producing an economical heat, and at the same time of ventilating them, by causing a continual circulation of air, in that state which is most conducive to health and comfort, are certainly of great importance and difficulty.

In all the different modes by which these effects are usually more or less produced, there are involved two very distinct principles, which produce corresponding changes in the condition of the air contained in the rooms where they are brought into operation. One of these principles may be termed that of diffusing heat by radiation from fires and heated surfaces, and the other that of heating air and making the diffusion of it a vehicle for conveying heat to the places where it may be required. The alterations produced in air by heat, so as to render it more or less salubrious, according as one or other of these principles is brought into operation in the different modes adopted to warm and ventilate rooms, will now form the subject of consideration.

When rooms are warmed by radiated heat as from ordinary fires, the temperature of the air which they contain is not so greatly raised as when heated air is made the vehicle to convey and diffuse heat. By radiation heat is diffused independently of air. Air, like all other gases, is eminently a bad conductor of heat; and hence it is that any particle of air, being heated by contact with hot bodies, does not appear to communicate any portion of the heat so acquired to the contiguous particles, but its repulsive energies becoming developed, it pushes the adjoining particles to a greater distance, and thus increasing their volume and rendering their specific gravity less, they necessarily rise and make room for others to follow the same course. Nor is the mass of air in a room warmed by radiated heat being transmitted through it, but this heat meeting with more solid forms of matter, as with walls, &c., is absorbed by them. These walls and other bodies thus becoming heated, radiate in all directions, heating the air in contact with them; and this heated air then translates itself as when heated in contact with fire. There is thus a continual but gradual warming and circulation of air from all heated surfaces.

Now if we suppose a room of the following dimensions, $30 \times 20 \times 20$ feet, its cubic contents will be 12,000 feet. Let us suppose 1 foot to be the sectional area of the flue by which the products of combustion and draft escape to the atmosphere, say with a velocity of 10 feet per second. There would then be transmitted through such a flue in 10 hours, 360,000 cubic feet of air, which would renew the air of the room 30 times in that period, or 3 times in each hour during the day, an extent of ventilation sufficient for the most crowded apartment.

It follows, from the non-conducting and non-absorbing power of air in relation to heat, and from its being so frequently renewed, that the temperature of air contained in rooms heated by ordinary fires can never be great, but that the warmth which is felt in them is in a great degree the effect of radiation, and not that of heated air. This process of warming and ventilation is exactly that adopted in the general habitation of man and all organized beings—a strong *à priori* proof that their physical organization is adapted to such conditions of the air as this process induces, and to no other. That such conditions do obtain in the physical atmosphere, is evident. If air absorbed the heat of the sun it could not reach the earth, but would produce a temperature in the upper part of the atmosphere, that might precipitate showers of rain little short of boiling heat, and cause tempests of the most violent character, owing to the great extremes of temperature to which it would be liable, for under such circumstances the temperature of all bodies must be as the quantity of heat they intercept.

In all methods of warming rooms by heated air, as by passing it through hot pipes, or by means of cylinders containing coils of pipe, heated by the circulation of hot water, the mode of diffusing heat is the same. The air is made hot and poured into the rooms in a continued stream, supplying heat and ventilation. The important difference between this and radiation is, that the air is first made hot and gradually communicates its heat to some parts of the room. Air so circumstanced, must be hotter than any object to which it imparts heat, while the reverse is the case where radiation is employed. As heated air is lighter than cold, it is quite evident it will chiefly occupy the upper part of rooms so heated, especially when it is diffused from one aperture, and that at some distance from the floor. By testing with a thermometer, it is found that rooms heated by hot air are increased in temperature about two degrees per foot from the floor upwards, so that a person of ordinary dimensions might be said to have his head in a summer and his feet in an autumn temperature; a condition which justly and generally considered the reverse is of what it should be.

But by far the most important and injurious are the effects which heat produces on the air with respect to the quantity of aqueous vapour which it contains, for on this depends its power to absorb more, or to precipitate that which it holds. According to Dr. Dalton, the amount of aqueous vapour which the atmosphere can contain at any given temperature in a state of invisible steam or vapour, is a fixed and definite quantity for that particular temperature. If that temperature be lowered, the point of saturation is also reduced, and the particles of vapour losing a portion of their repulsive power, coalesce and form sensible humidity or dew. If, on the contrary, the temperature of air be raised above any given point of saturation, the constituted tendency of water to become vapour is permitted to take effect, with an energy proportional to the increase of heat; hence the dessication of all surfaces exposed to its influence proceeds at a rapid rate, when they are immersed in air raised much above the temperature of the atmosphere. At all times and places the atmosphere is generally at or near the point of saturation with aqueous vapour. Taking two rather extreme cases, Glasgow in Scotland with a humid state of air, and Funchal in the island of Madeira, the mean temperature of which are 47° 75′ and 66° 3′, the mean dew points are 45° and 61°, indicating forces of elastic vapour of 0·3 and 0·538 inches of mercury, all respectively. We thus see in a moist and also in a dry climate of great salubrity the near approach of the air to saturation with aqueous vapour, so that its general tendency to absorb water is not great.

It will probably be thought by some, that the general state of the atmosphere in the consideration of this subject, is inapplicable; but it should be recollected that the same wisdom which contrived the organization of all living beings made also a state of atmosphere adapted to that organization.

Now, suppose air in the cold of winter at a temperature of 20° raised to that of 70°, by passing over coils of heated iron, or in any other way, it must absorb with avidity, every particle of moisture thinly spread over large surfaces. Having just been transferred from an atmosphere of 20°, it could not be much more than saturated for that temperature; and consequently the heat has produced a condition of air which is nowhere to be found in nature, unless, indeed, we except the sirocco of the arid sands in Western Africa.

Persons who pass large portions of their time in apartments heated and ventilated in this way, feel extreme dryness of the skin, fulness and throbbing about the head, soreness of the eyes, a dry and kind of asthmatic condition of the mucous surfaces, general excitement, and in some degree prostration of strength.

Medical men have frequently employed hot air baths for their stimulating effects; but that which generally exercises a beneficial power in extraordinary states, as in disease, must surely have a deleterious influence when permanently in operation, even in a less degree than that commonly employed for medical purposes, and especially in states of bad health of an opposite character to those for which it is employed as a remedial agent, as for instance, when any tendency to apoplexy exists.

It has been proposed to remedy the dry state of hot air, by evaporating water, conveying steam with the heated air, &c.; but all such means are too complicated for the intended purpose, and incapable of adaptation to the circumstances of the case. For during the time when the apparatus is not in use, if the air had been near a state of saturation with aqueous vapour during the day, a large precipitation of dew would take place on cooling, and also during the day, owing to considerable changes of temperature. From these facts and circumstances it is evident that an ordinary fire fulfils all the principal objects of warming and ventilation, better than any of the unnatural modes which science, ingenuity, necessity, or desire for novelty has yet given birth to.

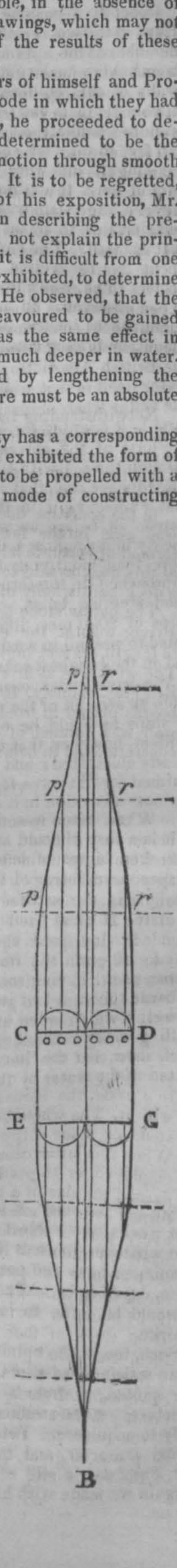
W. G.

THE FORMS OF SHIPS.

THE great importance of naval architecture induces us to return to the report of experiments conducted by a committee of the British Association for the Advancement of Science, which was read at their last meeting at Cork. The account copied into the last number of our *Journal*, from the *Athenæum*, was chiefly limited to the notice of the experiments themselves, and merely adverted casually to the deductions founded upon them, without describing the form of least resistance which the committee recommend as the result of their five years' labours. We have since been supplied with a further account of Mr. Scott Russell's exposition, and as the experiments have been more numerous, and have been conducted on a larger scale than any previously made on the subject, we think it desirable, in the absence of the voluminous report of the committee and drawings, which may not be published for years, to state at least some of the results of these long-continued and costly experiments.

In Mr. Scott Russell's exposition of the labours of himself and Professor Robison, after mentioning minutely the mode in which they had conducted their experiments, and their results, he proceeded to describe the form of construction which they had determined to be the best, not only as offering the least resistance to motion through smooth water, but also as best adapted for rough seas. It is to be regretted, however, that in this, the most important part of his exposition, Mr. Russell was less explicit and not so minute as in describing the preliminary experiments. He stated facts, but did not explain the principles by which they were regulated, therefore it is difficult from one isolated form of construction, which was all he exhibited, to determine how far it is adapted to vessels of other sizes. He observed, that the great point which, in the first instance, was endeavoured to be gained was to get rid of the wave at the bow, which has the same effect in retarding a vessel as if it were immersed so much deeper in water. It was found that this object might be attained by lengthening the ship, and that whenever speed was required, there must be an absolute length without regard to breadth.

Mr. Russell having stated that each velocity has a corresponding form and dimension peculiar to that velocity, he exhibited the form of the light-water line of a steam-vessel intended to be propelled with a velocity of 17 miles an hour, and explained the mode of constructing it. Suppose the breadth, C D, of the vessel to be 25 feet, there must be set off forward from the greatest midship-section 120 feet, and for the after-part, 85 feet. To make room for the engines, there is no objection to putting in a piece in the middle of the vessel, called the middle-body, of equal width to the greatest midship section. On half the breadth of the vessel, fore and aft, describe the semicircles C, D, E, G. Divide the fore part, *o* A, into a given number of equal parts, and divide the semicircles also into the same number of parts; in the accompanying diagram, we have divided them into not more than four, for greater distinctness. Then draw lines parallel to the keel, A B, from the divisions *o*, *o*, *o*, of the semicircles to the corresponding divisions *p*, *p*, *p*, and *r*, *r*, *r*, of the keel, and the points where the lines intersect show the form of water-line required. The form thus attained, it will be observed, is very sharp both fore and aft, though the after part, or run, being shorter, is necessarily more full than the entrance of the vessel. This form is much opposed to the ordinary practice inasmuch as the line is hollowed out or partly concave, instead of being of the convex form, or full bow, which old ship-builders so much admire.



Having thus described the form of the light-water line, Mr. Russell promised to give the view he entertained of the principle on which the superiority of its construction depended; in this particular, however, he failed to make himself very clearly understood. He first alluded to the notions entertained of the manner in which the water is displaced by the motion of a vessel. It is commonly supposed, by ship-builders, that the water passes round the vessel; some imagine that the fluid is rolled under it; whilst, according to the French philosophers, the impact of water obeys the same laws as the impact of solid bodies, and the water is reflected from the bow at an angle equal to the angle of incidence. From the latter assumption they deduced that a round full bow is best adapted to meet with least resistance. It had been proved, however, in the course of these experiments, that the particles of water displaced by the bow of a vessel move into new places, that peculiar motions are given to them, and that they never return to their former positions. The motion of displacement, also, was found to be not confined to the vicinity of the vessel, but to have an extensive effect in a region anterior to the bow, and extending to a considerable distance on each side; and some time before the bow approaches a particle of water, the fluid has commenced moving. Viewing the sea as composed of innumerable vertical columns of water, the effect of the approach of a vessel is to produce greater pressure on one side of such columns than on the other, and water being, practically speaking, incompressible, the particles pressed against can move only in a vertical direction, and thus a heaping up of fluid is produced before the bow of the vessel, sometimes ranging as far as half its length. The next object the committee had in view was to examine the direction of the motion of the particles of water displaced by a vessel. It was found that when the form was that of least resistance, the motions of the particles of water were in semicircles; and that they deviated from that curve when the form departed from that of least resistance. It was also determined, that the replacement of the water as a vessel moves forward, takes place entirely from below. The result, therefore, to be attained, as appeared from these experiments, was to ascertain the form of the solid of least resistance, which would communicate these motions to the particles of water. In experiments on the forms of waves, conducted also at the expense of the British Association, it had been ascertained that the motion of water itself is that which the committee had endeavoured to give to the water when ships pass through it. Thus it happened, that the form best adapted for least resistance in smooth water, being itself the form of the waves of the sea, the vessel of that shape moved through the sea with the least motion and the least resistance. The consequence was, that in the course of these experiments it was found that a vessel built in the form of least resistance in smooth water, instead of being, as was formerly supposed, likely to be wet and uneasy in a rough sea, in fact passed through the waves without doing more than modifying their motion, and that in proportion as ships approached to the form of least resistance, they were dry, easy, and good steering boats. The concluding experiments were made on ships of 2000 tons, differently formed, and the same law which was found to prevail in smaller vessels was also followed in the large ships and in the roughest seas.

We have endeavoured, on the foregoing report, to give as intelligible an account of the deductions from the experiments on the form of ships as could be collected from Mr. Russell's exposition. It is evident, however, that there are many points of importance not sufficiently elucidated; and though the principle on which the advantages claimed for the wave form is attempted to be established as regards easiness of motion in a rough sea, the reason why that form is the one of least resistance in smooth water, is by no means clear.

It is a very difficult, and perhaps an impossible task to extract the pith from a voluminous mass of papers, calculations and drawings adapted to differing circumstances, so as to present, in a comparatively small compass, a satisfactory view of the whole; nevertheless, we wish to arrive at some fixed laws, and the principles on which they are founded. It appears that in all the experiments the object aimed at was to ascertain the form of least resistance in *cutting through* the water, and that no attention was bestowed on the form best adapted to cause the vessel to glide over the head-wave. The experiments, however, which were made a few years since on the Scotch canals with passenger boats, in which we believe Mr. Russell himself took part, show that the head-wave may be prevented by the boat being raised in the water by the oblique impact of its bow with the fluid.

BRITISH MUSEUM.

Sir—If but small, it is some satisfaction to find that within the few last weeks, the subject of the British Museum has made a little stir; and whatever journals have touched upon it at all, have been pretty unanimous as to two points—first, that the building—at least the façade, *ought* to be made a noble piece of architecture; secondly, that it would be futile to look for any such production from Sir Robert Smirke.

Such, too, is the opinion which has been expressed by the *Spectator*, in an article headed "Completion of the British Museum," wherein are quoted, as from a correspondent, "some severe, yet deserved strictures on the architect," in which the journalist himself appears fully to acquiesce. Yet after so far inculpating Sir Robert's professional character, and quoting a long list of his architectural failures, the *Spectator* is still of opinion that we ought now to abide by the bargain we made with him—or rather, which has been made with him for us.

"Any glaring defect," it says, "in the front, ought to be amended, as far as it may be, by Sir Robert Smirke; but we question if it would be right and just to take the work out of his hands, and intrust the completion to another architect, even if the Trustees of the Museum would do so—which is not very likely."

Certainly not; for the Trustees—who have shown themselves not fit to be at all trusted with their building, as far as architectural taste is concerned—appear to care nothing about the matter. They are satisfied themselves, and whether the public is or will be satisfied, is to them perfectly indifferent.

The *Spectator*, too, thinks, that as things have already gone so far, we ought now to be reconciled to what can't be helped, stipulating only that "Any glaring defect should be amended!" Now, in the first place, Sir Robert Smirke is not at all the man to commit "Glaring defects;" much less is there any danger of his violating the decencies of common place, he knows what the mere good-breeding of his art requires, too well, to shock us by gross improprieties—he has "*larnt manners*."

In the next place, it is truly astonishing to find a writer professing to be a critic in art, well content, if instead of a façade worthy to rank high as a finished work of art, we do but get one free from "glaring defects."

But just now, I said that Sir Robert was not the man to commit glaring defects, yet must correct the observation, for one most glaring, pervading defect stamps all his buildings: they are all alike sullen and soul-less—dull and unimaginative—the very best of them of that kind whose highest praise and damnation are condensed into the epithet "Respectable!"

His designs are of a sort that do not admit of being corrected, otherwise than by being remodelled and recast, and having some spirit—some ideas, infused into them.

The *Spectator* concludes with saying, "let us hope that the façade will be 'respectable,'" and in this there may possibly be a sneer of contemptuous irony; for hardly is it possible to conceive that any one should seriously mean to say we ought to consider ourselves well off if, instead of a magnificent edifice capable of challenging any other work of its kind in any part of Europe, we do but get what will barely pass muster as "respectable."

For Sir Robert Smirke himself I have no pity; he deserves none: he merits all the obloquy and ignominy he is about to draw down on his devoted head. Fortune he has made—fame he has missed; why then does he not now distinguish himself in the only way left for him. Let him act the Roman part—let him claim if not the applause of his country as an artist, its gratitude as a patriot willingly immolating himself for the public weal. Let him heroically resign the British Museum to some one worthier of the task, and then, be all his sins forgiven.

C——s.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. 2.

The Houses of Parliament, the Exchange, and the Conservative Club in St. James's Street, are in progress; and the façade of the British Museum is spoken of. I trust Mr. Barry in the first will avoid an error in his otherwise much to be admired school of King Edward at Birmingham, and give us windows of a bolder and broader character.

There are only three orders of columnar architecture worthy of imitation, viz., the Grecian Doric and Ionic, and the Corinthian. I most sincerely wish that the knowledge of all others was lost. The indignation of a man of taste should boil, at seeing the ornaments and emblems of these beautiful orders prostituted, by being coupled with the vile trash which is given to the public as their imitations: the triglyph indicates symmetry and stability in the Doric compositions of the Greeks; but in the lower order of the Exchange, weakness and an overburdened architrave. Could not Mr. Tite remove this index of overweight and undue proportion, and call his order Tuscan, a name more to be honoured than any other form of debased Doric.

At least the Conservative Club in St. James's Street aims at having one advantage over the Reform in Pall Mall, namely, the representation of a collection of the boxes used by Her Majesty's ministers, (for such is the shape of the quoins,) intending by this, perhaps, to show the determination of the Conservatives to retain their places: if such be not the indication, we must seek the reason, for the rustic work, in a similarity of taste with New Zealanders and other polite nations of the Pacific, who tattoo their faces, and consider scars and scratches as so many lines of beauty; for my part, as I prefer the face human without the scars, however geometrical, so do I the face mural, without the rustic lines and gashes. A writer in this *Journal*, with much wit and truth says, that lawyers and architects are the only men who are the slaves of precedent. I wish that some high authority, in addition to experience, could be brought forward to show that as the savages in vain attempt to hide the nakedness of their bodies by tatooing, so do some architects, by treating their buildings in the same way, in vain attempt to hide the nakedness and meanness of their designs.

Much dissatisfaction has very reasonably been expressed at the secrecy observed with regard to the expected façade of the Museum. Sir Robert Smirke, no doubt, says, "From the character of my other works, you may safely rely on the fitness of the forthcoming façade." The delineator of Magna Grecia said the same thing under similar circumstances with respect to the National Gallery: for my part, my faith in Sir Robert is not so strong; the only work we have of his (I believe) in Ireland, is the Wellington testimonial, and a decided failure it is. Of all the works of a monumental character which the ancients have bequeathed to us in possession, the pyramids are the least, and the obelisks the most pleasing: the Wellington testimonial partakes of the character of both, but approaches more nearly to the deformity of the first, than the beauty of proportion to be observed in the latter; the height of the shaft is only about 5½ diameters, instead of being 9 or 10 as in the obelisks.

Without being possessed of any private information on the subject, we can easily say what the façade will be—a portico of six columns, with plenty of triglyphs on the frieze, in compliment to the Lapithæ and Centaurs of the Elgin marbles, and to show the possibility of having an architrave which shall appear to be overburthened and yet not give way; to borrow a phrase used in the description of civic feasts, like the tables loaded with viands it shall appear to groan! Then we shall have a pseudo portico at each flank by way of wings, with sham pediments also, stolen from the gable end of some Greek temple, not to surmount another gable, but a long colonnade like the river front of Somerset House, requiring three, and spaces between. On these misplaced pediments we shall have various apothecary-looking works, copied either from those of Somerset House or from the antique models to be found in the Museum. These three porticos will be advanced a little in front, for the purpose of showing that they do not belong of necessity to the building, but on the contrary, may safely be removed for any other purpose *si opus sit*. No, Sir Robert avoid these peculiarities, and give us a front something like that of the Berlin Museum; and do not be afraid of the spectator's eye requiring to be relieved by broken lines and cornices, nor seek to give your design a military character, by the introduction of cocked-hat pediments over your doors and windows.

I formerly made some observations on these ornaments, (?) to which a critic under the signature of G. W. R., in the fifth volume of this *Journal*, page 128, says in their defence that, if these gable tops be absurd in Palladian architecture, shall we not be obliged to condemn quite as much the beautiful pedimented canopies over the windows of York cathedral. This does not appear to be a *sequiter* any more than that it should be argued that because pointed arches, flying buttresses, pinnacles and finials are introduced into such edifices, with complete success, it would be advantageous to mix them up in a Grecian composition. But although G. W. R. truly says I was unable to discover the use of these window tops, yet he might have observed that, with great disinterestedness, I gave Palladio all the merit of the discovery, and that I merely suggested that one figure would answer as well as Palladio's two. If any architect who admires these window pediments so much, would have the kindness to exhibit himself undressed, and Bacchus like, astride one of those at the Reform Club House during certain hours of the day, admiring spectators might at a glance decide on the advantage of my suggestions, as compared with the practice of Palladio, the effect of whose plan might be shown by two other architects on an adjoining window.[1]

I have to complain that the same critic misrepresents me, (and critics do some times misrepresent,) by making it appear that I derived the pointed style directly from the Roman. Now I asserted no such thing, but referred to the ruins at Spalatro for the origin of the semi-circular arch on slender columns, supported by consols, (see Vol. V., page 79 of this *Journal;*) and as it is generally admitted that the pointed arch was formed, and in point of fact can be formed, by the interlacing of the semicircular arch, it is not going too far to say that even the beautiful pointed style may owe its origin *indirectly* to the debased Dioclesian.

[1] See Palladio's works, book II, chap. 3rd, plates iv, vi, and xviii.

I cannot see the force of G. W. R.'s objection to my saying that the graduated basement of a Doric temple might be considered as the base of the columns: the observations made by me on that head were with reference to a portico, which has no basement raised above the level of the street, (see page 80.) But if G. W. R. had read the paragraph preceding the one he censures, he would not have raised an objection.

To return to the Museum—if pure Grecian architecture must abide its time, and that we are not yet fit to appreciate its merits, let Sir R. Smirke consult the magnificent works on Egyptian antiquities, published by the Imperial Government of France, and give us an Egyptian front. No building ever was, or perhaps ever will be, erected in London, more suitable for that style than the Museum. But I speak of the court yard as it was when I last saw it three years ago.

In College Green, one of the best situations in Dublin, there is in course of erection a gin palace—I beg pardon, it is intended for a bank, but the fitness of the thing might well excuse the mistake, and indeed it is quite impossible to look at it without being struck with the resemblance. I had intended to give a drawing of it, but as there is no lack of palaces in London, it would be a waste of space in this valuable *Journal;* besides, the building, although of cut stone, is of so slight a nature, that it does not appear intended to remain very long. The architect of it, (if such there be,) with a taste which does him credit, and with a spirit of chivalry worthy an architect belonging to a free and enlightened people, viewing the over-burthened state of columns in the hands of modern architects, has in the present instance relieved his from any such irksome tasks, and not obliged them to support anything, for the perpendicular line of the edifice falls behind them; to be sure there is a kind of cornice on a level with the commencement of the first floor; but what of that, the whole is in "a free unhoused condition:" and by this expedient he has been enabled to make the columns more slender and graceful than any example with which I am acquainted. And after all, the idea of making the edifice resemble a palace was not a bad one, for with little or no alteration, it can at any time be turned into one, should it no longer be required for a bank, or should its neighbours of Trinity College, the Bank of Ireland, or the Royal Irish Academy, require a gin palace in their vicinity, *sic transit gloria mundi*, that is, "to what base uses may we return, Horatio."

THE PALACE OF WESTMINSTER.

SIR—Reports both official and popular relative to the Palace of Westminster are all highly favourable and satisfactory; still there is one point, and that of no small importance, in regard to which nothing has yet transpired, nor have any questions been put. Far as the structure is now advanced in appearance, it is appearance chiefly—along the east side of the plan: considering, therefore, the immense mass of inner buildings and courts there will be behind, and that all the present buildings on the west side will have to be cleared away, a very great length of time must elapse, before the entire pile can be constructed in its main walls, roofs, &c.

If I mistake not, the Peers' House is to be finished within about two years from the present time; but surely that does not include decoration, supposing that fresco-painting is to form any portion of it. And even then, the accommodation for public business, so far afforded, will be very limited and imperfect, unless all the contiguous parts of the plan can be carried on at the same time. Should that not be possible, no small inconvenience is likely to be felt, both by their Lordships, and by the architect, who will have to exercise a good deal of management and contrivance for which there would be no occasion, were none of that part of the building required to be taken possession of, until it was thoroughly completed.[1]

The question—when is, or when can, the work of embellishment commence? is perhaps one which no one can yet answer; neither may any one be as yet prepared with a readier reply to that of—*Where* is it to commence? As fresco-painting will at first be somewhat of an experiment among us, surely the artists will not be allowed to try their "'prentice hands" on any of the principal rooms intended to be so decorated. It is most probable, therefore, that they will begin

[1] A similar sort of inconvenience is now experienced in the British Museum, where temporary passages and partitions are obliged to be erected while the workmen are employed on those parts of the building which have to be added or adapted to those already finished.

their operations in the corridors; yet if they are to be carried on there to the extent now contemplated, it must be either very rapidly or very slowly: either the whole work must there be executed with all dispatch possible when once begun, so that it may be got out of hand; or, it must proceed very gradually indeed, and perhaps only at intervals during a long series of years.

Our artists, I conceive, are likely to have ample time to prepare themselves for study, ere their services will be required for the Palace at Westminster, which may not be till some of them are grown grey-haired. As a last question—one which deserves to be well considered, will it be possible to grant the public that free access to the interior of the building, which it now seems to be taken for granted will be the case? The very plan shows that it is not at all adapted for the purpose of a public gallery of art, and that to convert it to such would be incompatible with the more important purpose for which the building is destined.

I remain,
Your obedient servant,
J. B.

THE BRITISH MUSEUM.

(With Plan of Façade.)

WHETHER or no any positive beneficial result ensue from public attention being kept alive as to the British Museum, the subject is one that is very far from being yet exhausted, and which ought not yet to be dropped. In fact, with the public generally it is but just beginning to make any sort of stir, and interest—at least curiosity, has been so far excited, that several inquiries have been made as to the possibility of obtaining a sight of the model which is deposited somewhere in the building itself. It was not very long ago rumoured that it was open to public inspection there, yet this turns out not to be the case, applicants being informed that the model cannot be seen without an express order from the architect himself: which is tantamount to a civil sort of peremptory refusal, since it compels individuals to solicit as a particular favour and indulgence what ought to be matter of public right, for if there be no general claim of that kind, the applying for the favour is no more than what might be done with equal propriety in any other case.

We were told that we might write to Sir Robert Smirke, but we were not at the same time assured that such application would be attended to; so thinking that it might after all, be very much like summoning spirits from the vasty deep, we declined making the attempt, as, we suppose, most others have done. The precaution adopted, is in itself a very politic one, for while it makes a show of a little liberality, and renders it impossible to say in strictness of truth, that the model is not allowed to be seen by any one, it effectually excludes those who are the likeliest to be able to judge of the design, and to express their opinion of it. It requires some sort of assurance to ask a man as a favour to be permitted to inspect a production of his, that you want to see for the express purpose of telling the public your opinion of it—be it ever so unfavourable. Accepted as the boon of courtesy, the permission itself becomes a bribe to criticism—a padlock upon its tongue: at any rate one does not feel at liberty to express one's opinion altogether so freely and independently as if he had paid his admission shilling at the door, or as where gratuitous admission is universal.

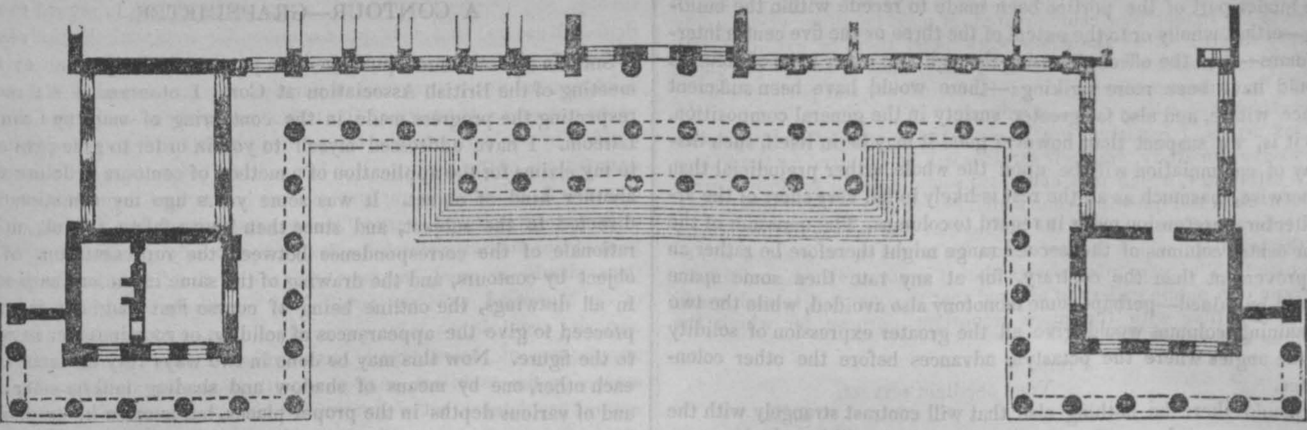
That the refusal of this last should still be persisted in is strange, yet by no means inexplicable, on the contrary, it suggests at once to the dullest apprehension, both of what kind, and how powerful the motives are which prevent compliance with what is but a reasonable demand on the part of the public;—more especially as it is impossible to allege in this case the slightest difficulty or inconvenience in granting facility of access, nothing in the world being easier than to remove the model from its "prison room," and place it in the hall of the Museum. In general, architects and artists rather rejoice than otherwise, when they find the public take particular interest in, and make inquiries as to the progress of the works they are employed upon. So far is it from being usual to show such excess of caution, silence, and reserve, as has all along been kept up in regard to the British Museum, that it is quite common for architects themselves to exhibit by publishing or allowing to be published, designs or views of buildings, while in progress, or perhaps only just begun. We could quote numerous instances of this: two may suffice—and those can be verified by our own readers, for we were enabled to give designs and descriptions of the Reform Club-house, long before that structure was completed, and have in our last number laid before them an elevation of St. George's Hall, Liverpool, nor has its author had any cause to repent of the publicity which his design had previously obtained. Why then, should so much mystery be made of the design for the façade of the Museum? as if the public had positively no right to feel any curiosity about it, to take any interest in it, or make it in any way, any concern of theirs. Such extraordinary reserve shown in this instance by the architect, may pass with some for modesty—for the natural bashfulness, not of sixteen, but sixty. Far more likely does it proceed from pride, or likelier still from the conscious foreboding that to exhibit his model to public scrutiny would be to sign its death warrant.

Notwithstanding, however, the most jealous precautions, something has transpired, and enough to lift up a good part of the veil hanging over the front of the British Museum, for knowing its plan, we can give a very tolerable guess at its elevation, and might even undertake to draw it out, and exhibit it as the architect's own; for such is his mannerism—so unvaried and stereotype, so bare and poor are all his *vertical plans*, that they may be dispensed with, and we may pretty confidently rely on such particulars as can be gathered from a ground plan alone, knowing that of ornamental design and decoration, there will be nothing except what arises from the order itself, or rather from the columns, all the rest being bald and naked. Such being the case, there is, after all, very little necessity for demanding to see the design, since we may fairly be said to have been made fully acquainted with it already, the plan being published in a parliamentary report, so long back as five years ago; nor is it at all likely to have since undergone any alteration—any correction or modification, for Sir Robert is not given to vacillation; he knows his own mind—abides by his first idea, instead of foolishly endeavouring to improve upon—perfection.

At all events, nothing has been said as to another design having been since substituted, as would undoubtedly have been done, were such really the case, in order to disabuse the public of a very great mistake. We may, accordingly, with that design or plan before us, and here exhibiting a reduced copy of it to our readers, which will enable them to follow us in our remarks, and spare ourselves a great deal of tedious explanation—proceed to criticize it.

It will at the first glance be seen that there will be a considerable degree of effect—and that of a kind we are unaccustomed to, produced by continuous columniation, breaking round the outline of the plan, and thereby displaying lines of columns at right angles to each other, consequently varied in their perspective appearance, and in regard to light and shade. We freely admit that so far we shall have something classical, even striking in character. Strange, indeed, would it be, if forty-two fluted Ionic columns, ranged continuously, but on different lines, did not produce a certain sort of grandeur; and we may venture to say that the *first-sight coup d'œil* cannot very well fail of being impressive. So far, therefore, all very well; yet in such a case, surely *so far* is very far indeed from being far enough, since it will be by no means sufficient if the façade be calculated merely to captivate the eye, on a first and cursory inspection of it: on the contrary, all the more likely is it, in consequence of the pretension and promise so made, to cause disappointment and dissatisfaction, after the feeling of mere curiosity has been gratified, and it is then discovered to be one of those things which have the peculiar merit of "looking best at a distance," a merit, by the bye, which is more common than we could wish to find it. It is neither every building, nor every person, that improves upon further acquaintance: of both there are not a few to whom we may apply the line of the epigram—

"He less had liked you had he seen you *twice*."



So, too, in the case of the façade of the Museum, it proves on examination to be very far from fulfilling the promise made to the eye at first sight: the circumstance of there being windows at all must prove, if not fatal, a very serious drawback, where the most *starched* classicality is affected as far as the mere order is concerned. Such apertures must inevitably destroy one essential characteristic of a Grecian colonnade—breadth and repose. Hardly any skill can reconcile together the style represented by the columns, and that by the windowed wall behind them: at any rate *purity* of style is forfeited, and a mixed one substituted for the original, therefore it becomes indispensable to render that *mixed* a *compound* one, wherein the respective conflicting elements shall be brought into harmony—the whole into keeping. Having passed the Rubicon it is of no use to halt, for then to stand still is to have done nothing; so when an architect has not scrupled to violate the simplicity of Grecian architecture, by introducing windows, he must either convert them into features of positive beauty in themselves, or leave them to be reprobated as solecisms and blemishes. No excuse will it be for him to say that he has no sufficient authorities to guide him for windows of rich and ornate character in the Grecian style; since neither has he any authority for introducing windows at all, and if he can break through authority as to the one, he surely need not scruple to do so as to the other—especially when by so doing he would have an opportunity of showing his taste and invention, and convincing us that his study of antique design had furnished him with resources not at every one's command.

We admit that we are here setting up a high standard of taste, and exact much more than is generally to be looked for; yet not at all more than the occasion both demands and admits of. Surely it is not at all unreasonable to expect that a Museum—a National Museum—one perhaps the first in the world in regard to the treasures it contains—should be also a splendid and perfect work of art, as a piece of architecture. Are we to be content with merely having something tolerable—decent—respectable—passably good, and so forth? That humble degree of merit could be obtained much more cheaply—without such an array of columns, without so much pretension, the effect might perhaps be all the more tolerable in consequence. We have had quite enow samples of *tolerable* Grecian architecture before; and now, we fear are about to have one again, where it, to be no more than tolerable, will be actually insufferable and disgraceful.

That the plan will be exactly followed in regard to there being windows within the colonnades and portico, is now but too evident, for the main walls of the building forming the west pavilion or wing of the façade, are now raised—that is, in rough brickwork, to be afterwards *faced* with stone, just as an old building might be *refronted* with new material; and from them we perceive that there will be a single range of windows, on about the same level as in the quadrangle or inner court; and they will, no doubt, be nearly of the same character, with no more dressing than will just be sufficient to prevent our saying that they have absolutely none. In this respect, therefore, the colonnades of the Museum will be almost exactly such compositions as is that which forms the centre of the Custom House, with all the less excuse, because if Sir Robert could not foresee the effect before, that experiment ought to have convinced him that it would not do to be repeated in the Museum, more especially as the public will naturally look for greater refinement of taste and display of imagination than in a Custom House or a Post Office—even for some evidence of poetic inspiration; but we suspect that the architect of the Museum is better acquainted with per-centage than with the muses.

Were the number of the windows in the façade reduced to half,—the plan should have been so contrived that there should have been no necessity for any—corresponding with the *alternate* intercolumns; there would have been some degree of breadth and repose, whereas now they will cut up the background, and what is more, they will not correspond with the intervals between the columns, at least not on the sides or returns facing east and west, for there, instead of falling exactly in the axes of the intercolumns, there will be—according to the official plan, at least—no regularity in that respect, for in some instances the windows will be partially, and in two others, exactly behind columns! besides which, there will be some windows thrust quite into the inner angles of the plan. How such a very strange disregard to the most ordinary rules of symmetry should have arisen, it is easy enough to perceive, it being evident enough that being unable to hit upon any mode of keeping up symmetry of arrangement in his windows, both internally and externally, the architect has sacrificed exterior to interior appearance, thereby incurring, we think, the far greater evil of the two, since defects of that kind, if to be tolerated at all, might more easily be excused in such rooms as come into this part of the plan, since they will not be seen by the public, the former being for manuscripts, the others for the Trustees, than in the "grand and classic" façade, where such blemishes are likely to be noted by every one as most strange and sad architectural bungling. Surely Sir Robert Smirke could never have given a second thought to his own plan, or even he must have detected such very palpable "school-boy" mistakes. Or are we to suppose that detecting, he could not remove them?

Come we now to the central portico: here an advanced line of columns added to the general colonnade forms an octastyle which will, doubtless be crowned by a pediment; thus, besides some variety being imparted to the *elevation*, there will be some richness and a more than ordinary degree of perspective intricacy will attend the inner range of columns seen behind those in front, of which disposition of them we have as yet no example in any of our London porticos. Still it may be questioned if such arrangement of the columns is the very best suited for the occasion, because there is hardly sufficient space for so many columns in that direction within the portico, the latter being rendered thereby nearly as shallow as far as actual serviceableness is concerned, as the other colonnades. There will be no amplitude of space any where, the entire plan of the portico being subdivided into so many lesser squares of uniform size; whereas, had the hinder part of the portico been made to recede within the building—either wholly or to the extent of the three or the five centre intercolumns—then the effect of passing through two outer rows of columns would have been more striking;—there would have been sufficient space within, and also far greater variety in the general composition. As it is, we suspect that, however good it may be in itself, such display of columniation will be upon the whole rather prejudicial than otherwise, inasmuch as all the rest is likely to fall very short of the architectural pretension made in regard to columns. The omission of the four centre columns of the second range might therefore be rather an improvement than the contrary, for at any rate then some space would be gained—perhaps some monotony also avoided, while the two remaining columns would give all the greater expression of solidity to the angles where the octastyle advances before the other colonnades.

Should there be nothing else that will contrast strangely with the columnar pomp here affected, one thing there will be which cannot fail materially to impair whatever dignity is thereby aimed at. The door, it will be observed, is placed between two engaged columns at the same distance from each other as the rest, and must therefore be of exceedingly insignificant size in proportion to the scale of the order, the width of the opening not much if at all exceeding the diameter of one of the columns; low it must also be in the same degree, and will, besides, look quite squeezed in between the columns: truly a most splendid and august portal for that of a national museum![1] With such a door, and with windows also, the general character of the design will be any thing but classical or imposing, in spite of the show made by columns. Columns, however, constitute the alpha and omega of Sir Robert Smirke's architectural ideas, and capability of design—we had nearly made a mistake and said, his powers of invention, but invention he neither has nor pretends to have. Whether he intends on this occasion to stretch a point, and give us—not any thing new, but some variation of his usual Ionic, some richer example of that style in regard to the capitals, and something less mean and dowdyish than his entablatures hitherto have been, we know not; yet unless such be the case, even his colonnades—letting alone all the rest—will form but a very sorry "set out."

It is possible that, having only the plan to go by, we may have misconceived some matters, and may in consequence have expressed ourselves more unfavourably than we might have done could we have inspected the model. If *that* would at all refute the injurious surmises now spreading abroad, the withholding it from the public is no less foolish than it is, at the best, ungracious. However, the public voice may even yet prove too strong for Sir Robert Smirke and his supporters—and his admirers, too, if he really has any now, which we very much question.

Lengthy—some may say tedious—as our remarks have been, we could very easily have extended them, because we have only animadverted upon it as it is, without pointing out what might have been introduced into it. Still one circumstance remains to be noticed, more especially as it does not show itself in the wood-cut plan; which is, that in addition to the main building, there will be two subordinate wings or ranges of building for the official residences; and these cannot fail greatly to interfere with the general effect—to detract from and neutralize the display made by the façade itself, unless they were to be altogether shut out from view by screen walls, adorned architecturally—perhaps, with Doric colonnades, thereby continuing such porticos along the sides or ends of the front court, and yet with some variation of character.

[1] So far from showing any improvement in respect both to the entrance itself, and to commodiousness of space, the portico of the Museum threatens to be considerably inferior to that of the Post Office, and hardly better than that of the College of Physicians.

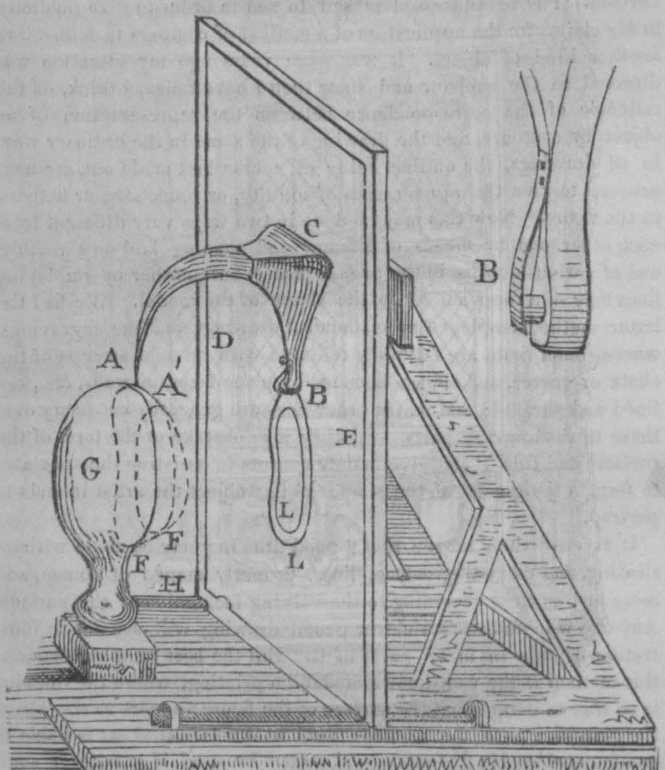
A CONTOUR—GRAPHIMETER.

Sir—In the accounts published in your valuable journal of the meeting of the British Association at Cork, I observed a statement respecting the progress made in the contouring of maps by Captain Larcom. I have addressed myself to you in order to give publicity to my claims for the application of a method of contours in delineating another kind of object. It was some years ago my attention was directed to the subject, and since then I have fallen, I think, on the rationale of the correspondence between the representation of an object by contours, and the drawing of the same in the ordinary way. In all drawings, the outline being of course first made out, we next proceed to give the appearances of solidity, or roundness, or flatness, to the figure. Now this may be done in two ways very different from each other, one by means of shadow and shading laid on smoothly, and of various depths in the proper places, but another by employing lines only of a form suited to the shape of the model. We find the latter method employed in academical drawings and line engravings, where round limbs are faithfully imitated with circular sweeps of the chalk or graver, and objects bounded by plane faces, as walls, &c., are lined and parallel; and whilst other lines are generally necessary over these to shadow the parts, still they also partake of the form of the surface, and this I conceive mainly concurs in assisting the spectator to form a judgment of the shape of the object the artist intends to portray.

It is easy then to see that a good drawing may be made without shading, and consisting only of lines, properly shaped of course, and more or less close according to the varying inclination of the surface. Any one who examines a clever pencil drawing will see ample illustration of this in many parts of it. But the best proof in favour of this method is the well-known medallion printing, where the drawing is so true to nature that the surface of the figure appears to rise above the ground. Now the machine used in this beautiful art is liable to create considerable distortion, and cannot be used if a bust or solid object is made the subject of trial. In 1839, while on service at Malta, I constructed a new machine acting on a modified principle, by the use of which all distortion was avoided, and I proved its efficiency satisfactorily to myself by copying some small casts. I had long felt the want of some such instrument, for I had had repeated opportunities of collecting casts both of remarkable living individuals and other subjects; but the limited space allowed to an officer on board a man-of-war precluded any attempt to form a collection of them, and therefore a machine to copy and measure these in every dimension, back as well as front, was a great desideratum, inasmuch as it flattened, as it were, solid objects, and enabled them to be so packed that a hundred casts might be put into a portfolio. Now the machine to which I allude is contrived to give all the outlines of successive planes of parallel section, or contours as they have been aptly called; and here I beg to remark the coincidence between the contours of Captain Larcom and my section drawings, not that Captain L. may well deserve all due praise for his important applications of the principle, but that it may not be forgotten that the same had been devised and put in practice by me in 1839. I have said that the machine measures as it draws—I mean that any measurement in any direction may be readily taken from the drawing. Now this is important to those who wish to copy subjects in illustration of national or individual peculiarities of countenance or form of skull in tribes of men or species of animals. It therefore commends itself strongly to those who cultivate physiognomy or phrenology in the practical way of comparative measurement. I proposed it once to an eminent phrenologist, who stated that such an instrument was indeed very much wanted, but he thought the photogenic process would in time supply that want. From this opinion I have reason to differ, as I believe none but linear drawings will ever give the necessary basis of measurement.

The annexed engraving is a representation of the instrument. A B C is the drawer or part moveable by the hand: it is so constructed with regard to its flat foot or base, B C, that it keeps the point A always perpendicular to the plane D E of the drawing-board at the point B; thus the line A B, in every position whatever of the sliding

Fig. 1.



drawer, A B C, keeps always parallel to itself; and, therefore, if a pencil is placed at B, whatever A traces at one end is drawn exactly at the other by that pencil. If A traces the contour A F, B draws the contour at B L. When it is requisite to draw another contour the drawing-board is screwed back the distance required by the adjusting screws H H, then the point A will trace another contour, A F, which of course is drawn at B L as before. In this way the whole solid, G, may be traced over. It is hardly necessary to notice that if a metal plate be substituted for the drawing paper, and a graver for the pencil, we may secure an engraving plate, whence copies may be taken.

By this apparatus profiles of the countenance, of architectural mouldings, and models of maps, may be taken without the use of the screw; and if constructed on a large scale, the lines of a boat, &c., may be taken with ease and expedition.

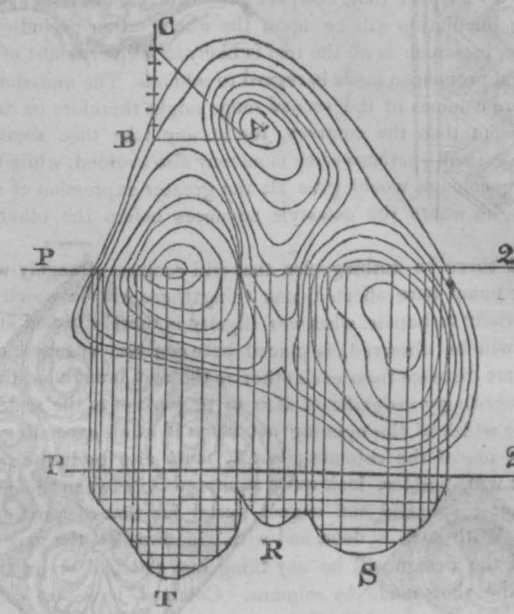
If it be desirable to make a drawing having the effect of a picture, the contours should be drawn close and blunt; but if a measurement drawing, they must be wider apart and sharp, so as to produce no confusion when the back parts are traced over.

Fig. 2 represents a plan of a piece of land with three hills laid down in contours from a model; each contour is a representation of the surface at certain given perpendicular distances, say one inch of the model; then, by taking the outer contour as the base or datum, each contour within will represent so many inches perpendicular above the base; it will thus be seen that the height of the three hills in the model by the annexed plan are respectively 6, 7, and 8 inches above the base.

If it is requisite to find the distance on the surface between A and B, *i. e.* how far they are apart in the original model. From B or A, as is most convenient, draw a perpendicular B C equal in height to all the sections between A and B, then will the line A C be the distance on the surface between A B.

Suppose it be required to make a section of a cast from P to Q, of which fig. 2 is a drawing, it will be first necessary to draw perpendiculars from the several intersections of P Q with the contours by means of parallel rulers, and then taking P′ Q′ for P Q at a distance

Fig. 2.



from the drawing, to avoid confusion, draw parallel lines to it distant from each other the height of each section. Where the former intersect the latter, draw the outline P T R S Q, which will give the section required. In the same manner a measure may be taken from the back to the front also, because the machine can draw, if necessary, the contours at the back within the same space as those of the front, and thus a solid object is drawn back and front from one point of view, and measured in every possible direction.

I have the honour to be, Sir,
Your most obedient servant,
SALTER LIVESAY, M.D., R.N.

GYPSOGRAPHIC SKETCHES[1] FROM THE PRIORY CHURCH OF ST. BARTHOLOMEW, SMITHFIELD.

With a Gypsographic Drawing, Plate XIV.

AMONG the great facilities which the metropolis affords for a school of architecture, must not be omitted the many monuments of different styles which it possesses. With regard to the early periods of English architecture, many admirable specimens exist, which, although abounding in points of interest, are not adequately studied—in some cases, indeed, are not adequately known. Many of these, from their recent restoration, have, it is true, attracted public notice, but many others, of no less merit, remain in comparative obscurity or neglect. To enumerate all the metropolitan works of the middle ages would be impossible, but to remind the student that they are not contemptible, we may call to his notice Westminster Abbey and the Chapter House, Westminster Hall and St. Stephen's Chapel, St. Mary Overy's,

[1] This method of Engraving (of which our present *Journal* contains several specimens, particularly those in this article of the Priory Church of St. Bartholomew the Great,) is a recent invention which bids fair, if it continues to progress with as rapid strides as it recently has done, to effect a very considerable revolution in the art of engraving, more especially in that department of the art termed wood engraving, or engravings printed from the surface at the type press. Our readers are doubtless aware that in the latter process a drawing is made by the artist upon a piece of box wood in pencil, and that those portions of the wood or block uncovered by the drawing are

Fig. 1.—View of Arches of the old Tower and Transepts.

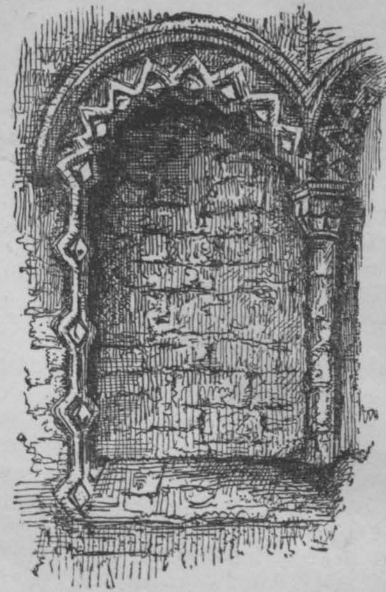


Fig. 2.—Arch in spandrel.

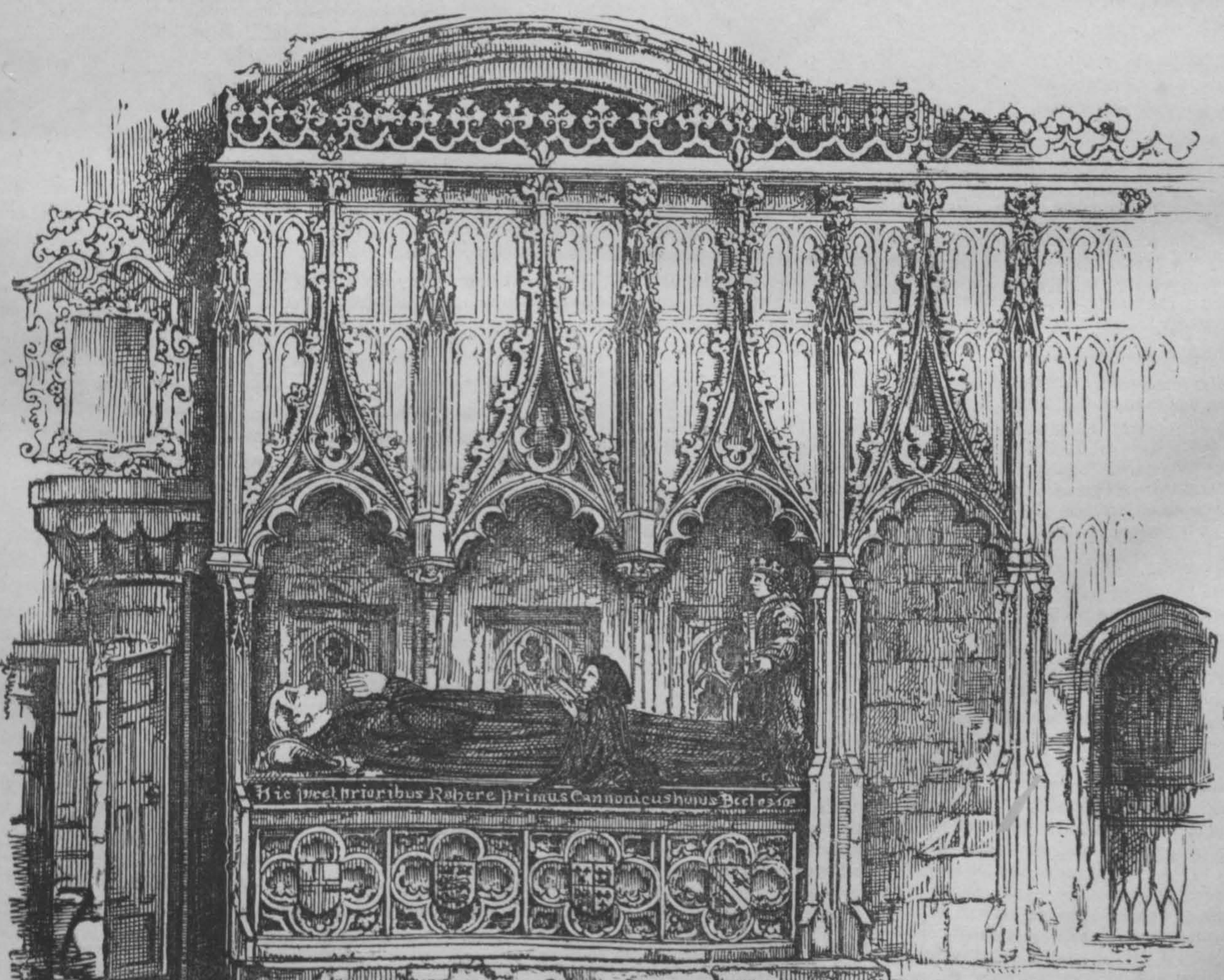


Fig. 3.—Prior Rahere's Tomb.

SKETCHES FROM THE PRIORY CHURCH OF ST. BARTHOLOMEW

Fig. 4.

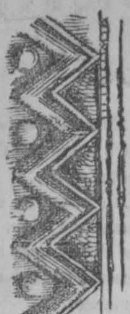


Fig. 8.

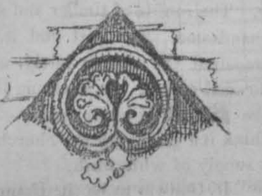


Fig. 7.

Fig. 9.

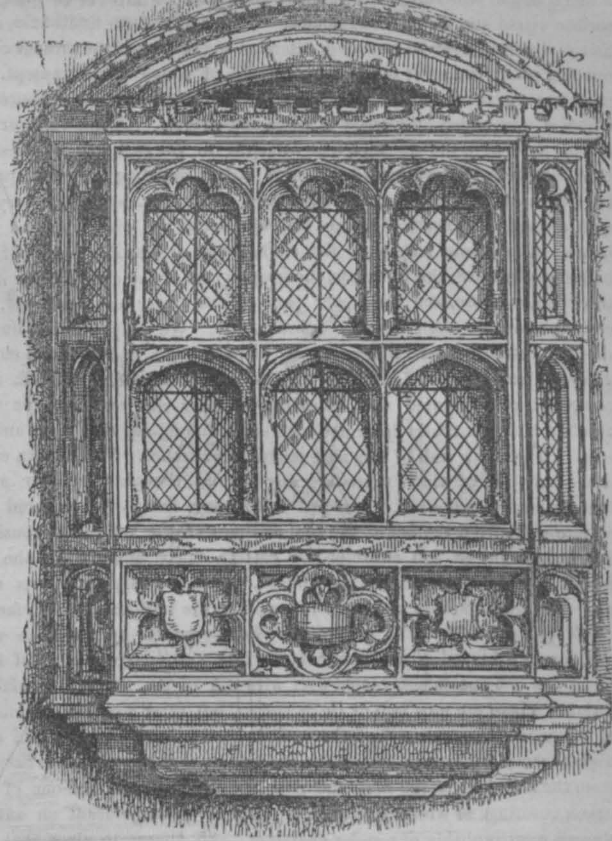


Fig. 10.

the Temple, besides many others. Several of these present points of great interest, and we hope we shall be affording some gratification to our readers, by devoting a series of illustrated articles to the architectural antiquities of the metropolis and its vicinity. The subject we have selected for the present occasion is the church of St. Bartholomew the Great, in Smithfield. Smithfield is a place it might be thought but little attractive for the architectural or antiquarian student, and yet to both it is of equal interest. Originally a large fen or waste, draining, probably, into the river Fleet, or some of the then pure streamlets of the city; it was, in the twelfth century, in a very neglected state, occupying a much larger district than now, and used as a market, the higher ground being the site of a gallows for thieves, and the scene of frequent executions. It seems to have been, at that time, the property of the crown, and, lying outside two of the city gates, it attracted the notice of the founder of more than one religious house as the convenient site of a large conventual establishment. The priory of St. Bartholomew was founded on the south, that of St. John of Jerusalem on the west, and that of the Chartreux on the north; and in their remains, and in the disposition of the modern buildings are to be found many interesting architectural relics, and very good studies of the arrangement of the ancient religious houses. Three establishments, St. Bartholomew's and Christ's Hospitals, and the Charter-house, keep up the hospitallary character.

The convent of St. Bartholomew the Great was founded about 1113[2] by Prior Rahere, who begged the site of King Henry I, for Black Canons of the order of St. Augustine; and upon the strength of a legend that it had been hallowed by King Edward the Confessor, obtained abundant alms from the Saxon people of London. Some, indeed, have supposed that the present edifice is founded on one of Saxon origin, as to which no records exist, but it is not improbable that some Saxon chantry or hermitage might have existed here. It is such a spot as the religious mendicants often chose; outside the city walls—close to a main road, and on the scene of traffic and of death, it would be a tempting settlement. Indeed, it was by no means uncommon for religious houses to be instituted on such foundations, and we may well suppose Rahere to have occupied some deserted oratory or cell Be this as it may, the bulk of the existing structure is clearly of Norman origin, and was raised by Prior Rahere during his lifetime, under the direction of Alfune, who built St. Giles's, Cripplegate. It was abundantly

[2] The Cottonian MSS. Vespasian, Book IX, says in one place, 1103, another 1113, and according to Dugdale it was 1123.

carefully removed by the wood engraver, a process extremely expensive, tedious, and often unsuccessful in producing the effect intended by the designer, all which evils appear successfully removed by this new method. The finer descriptions of wood engravings are also at present extremely limited in size owing to the impossibility of obtaining the material box wood of a larger size than six or seven inches square, but by the Gypsographic process there is no limit to size. It may by necessary to explain the term Gypsography: it derives its name from Gypsum or Plaster of Paris, which forms the etching ground used in this method.

The extreme simplicity of this invention is not the only great advantage it offers to the artist, draughtsman, or engraver, and may be readily understood by the following description :—

A plate of copper is thinly covered with a composition of which plaster of Paris forms the staple ingredient, and through which to the surface of the copper, the drawing or design is etched with an etching point; when the etching is completed the plate having the lines sunk in or drawn through the composition forms a matrix or mould, the plate then is cast in type metal by the stereotyping process, and a perfect cast or block is taken reproducing an exact facsimile of the artist's original design and which may be immediately transferred to the hands of the printer.

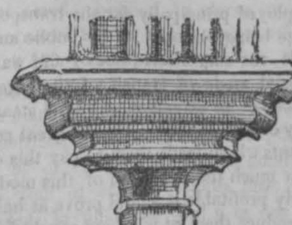
Wood engravings have hitherto been the only description of illustration capable of being conjointly used and printed with type, the great cost both of engraving and printing on steel or copper having been an insurmountable barrier to the general use of the latter in illustrating works requiring pictorial additions, but now as the Gypsographic process combines with it all the advantages of wood engravings both in printing and effect, as well as many of the peculiar advantages of steel and copper-plate engravings, we have but little doubt it will be generally and extensively used in the illustration of all descriptions of bookwork. Messrs. Milner & Co. the patentees of the process have several specimens exhibiting the art applied in a variety of ways which they will be most happy to show to any person who may favour them with a visit at their office in Racquet Court, Fleet Street.

strengthened with privileges, some of which are enjoyed by the inhabitants of the parish to this day. It is clear that the present church is only part of a much larger structure, and we shall endeavour to give some idea of its former extent and its present remains. On entering from Smithfield, a nave and two aisles, about 90 feet long, extended to the door of the present church, opening under the great tower, on each side of which was a transept. The nave was continued into the choir, the part now used as a parish church, and which is surrounded by a series of aisles and chapels. On the right or south of the nave were the cloisters, and attached to the east wall of these, and extending from the south transept, were a hall standing over a chapel, and latterly used by the nonconformists and Wesleyans, and a refectory, also, with a crypt underneath. Behind the east end of the choir was the prior's house. The whole length of the church was about 220 feet. Of these buildings the nave, the transepts, the greater part of the cloisters, the chapel, the chapter-house, and the upper part of the tower are destroyed. The church, itself, we shall describe subsequently. We may observe, however, that the entrance to the south aisle of the nave exists, and forms an entrance gateway from Smithfield. This relic is most deservedly admired, and is composed of a pointed arch, consisting of four ribs receding one within another, and beautifully decorated with numerous zig-zag mouldings and with roses. The south wall of this aisle is also in existence. The eastern cloister is the only one of which there are any remains, though the lower part of them is buried in the soil. A recent visitor[3] says that it has suffered much of late years from the fall of the roof and part of the wall, and consists of five arches more or less entire on the eastern side,[4] and one on the west, besides a portion attached to the church, which is complete, but is walled up. The workmanship is said to be very fine, the breadth about 15 feet, and the length about 95. The refectory is also described by the same writer. "It is now occupied as a tobacco manufactory, and a large portion of it still forms but one apartment, roofed over with oak of the finest kind and condition. There are now two or three stories, but, after a careful examination of the general arrangement of the multitudinous timbers of the roof of the highest story, we cannot but express our opinion that the whole has been open from the first floor to the roof, and that the latter has formed one of those oaken coverings of which Westminster Hall is so magnificent an example, though most probably of a ruder character. All appear to show that there was but one story, one room: and a glorious room it must have been, measuring some forty feet high, thirty broad, and a hundred and twenty long." The crypt under this magnificent hall is of the same extent, but crossed by an arched passage. It has a double row of aisles of pointed arches, and is in an excellent state of preservation. The prior's house is now used by a fringe manufacturer, and is an ancient building in pretty good preservation. The length is about 83 feet.

The external appearance of the church requires no description, being mutilated with facings of brick and stucco. The interior is, as we have said, composed of the under part of the tower and the choir, surrounded by aisles, separated from the choir.

The tower was formerly attached to the transepts now destroyed, and is formed by four arches, two of them, the one opening to the choir and the one opposite to it, circular, the transept arches being of less span and pointed, as shown in the accompanying illustration, (Plate XIV, Fig. 1,) so that the four form an oblong tower. They are all in good preservation except the western round arch, which is slightly shaken, and seem of the same age, as far as can be judged from the external inspection. The pointed arches are rather rudely formed. The whole four arches have, however, the same zig-zag moulding, Fig. 4; the two circular arches spring from corbels (Figs. 5 & 6). In each of the spandrils close to the angles, there are smaller arches, nearly at right angles to each other; one of them is shown at large in Fig. 2; with a peculiar zig-zag or indented border, and a column in the angle. There are also in the spandrels small lozenge-shaped panels remarkable for their singularity, the ornaments of three of them, shown in Figs. 7, 8, & 9, are something similar to the Grecian honeysuckle.

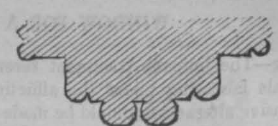
Fig. 5.



[3] London: No. 29, p. 50, Charles Knight.
[4] Pennant, London, p. 199, says eight arches in his time.

This part of the church is of the greatest interest, the mixture of the pointed and round arch seems to point to the contemporaneous use of the two styles at the period of the transition, and has been the subject of much controversy, and Mr. Britton (Chronological History of Christian Architecture in England) says "The cause is evident; for those sides of the tower being much narrower than the east and west divisions, which are formed of semicircular arches, it became necessary to carry the arches of the former to a point, in order to suit the oblong plan of the intersection, and at the same time make the upper mouldings and lines range with the corresponding members of the circular arches." Whether this be the cause or no, it is not easy to determine, but the two sets of arches seem almost without question to be of the same age.

Fig. 6. Section of arch.



The choir, which is in continuation of this tower, is in three stories; the lower part is in the Norman style, resembling some parts of Winchester cathedral. On each side are five round-headed arches, ornamented with a billet moulding, a peculiarity connected with which is that it is in some places carried over the cap of the column to the next arch. The second story consists of a triforium of five arches corresponding with the lower story. Each opening is divided into four by small columns and round-headed arches. On the south side one of the openings is occupied by a beautiful oriel window, Fig. 10, built by Prior Bolton (about 1500). Above the triforium is a clerestory of pointed windows, and the piers are pierced longitudinally so as to form a gallery all round the upper part of the choir. The roof is of timber and not very remarkable in its construction or very handsome. The east end is of modern workmanship by Mr. Blyth, who repaired the church lately, and contains in the lower part a range of round-headed arches. In repairing this part, the stone wall behind it was found to be painted in water colour of a bright red spotted with black stars.[5] We think it a great pity the church is not so painted now, instead of the abundant supply of whitewash.

Behind the altar is a chamber, supposed by Mr. Godwin to be the chancel, the interior of which well merits inspection, and which it is desirable should be thrown open to the church.

The aisles are about twelve feet wide, arched in the simple Norman style, lighted with windows of various dates. Over the south aisle is a school-room, or vestry, containing a beautiful Norman arch. The vestry which is attached to the south aisle seems to have been anciently an oratory dedicated to the Holy Virgin.[6]

The choir and aisles contain many ancient and interesting monuments, the most remarkable of which is that of Prior Rahere, the founder, which we have selected for one of our illustrations (Fig. 3, plate 14). "We find the monument of the founder in the north-eastern corner, almost immediately opposite the beautiful oriel window which Prior Bolton there erected, in order, perhaps, that when he sat in it the home of the ashes of his illustrious predecessor might be for ever before him. This is a work in every way worthy of the man whom it enshrines. It is one of the most elegant specimens of the pointed style of architecture, consisting mainly of a very highly wrought stone-work screen, enclosing a tomb on which Rahere's effigy extends at full length. The roof of the little chamber, as we may call it, is most exquisitely groined. At what period the monument was erected is uncertain; but the style marks it as of a later date than that of the founder's decease. But it was most carefully restored by Bolton (about 1500), and the fact is significant of its antiquity. As the latter found, no doubt a labour of love in making these reparations, so time itself seems to have seconded his efforts, and to have shared in the hopes of its builders that a long period of prosperity should be granted to it, by touching it very gently. Here and there the pinnacles have been somewhat diminished of their fair proportions, and that is pretty well the entire extent of the injury the work has experienced. The monument, it must be added, is richly painted as well as sculptured, and shows us the black robes of Rahere and of the monks who are kneeling at his side—the ruddy features of the former, and the splendid coats of arms on the front of the tomb below."[7] There are also other monuments of interest as those of Sir Walter Mildmay, and Archbishop Walden, Lord High Treasurer, remarkable for his patriotic resistance to the See of Rome.

As to the dimensions of the edifice great uncertainty prevails. Mr. Godwin has given no measurement. Malcolm gives it as 138 ft. long, 60 ft. broad, and about 40 high. Osborne as 132 ft. long, 57 broad, and 47 high.

[5] Churches of London, by G. Godwin, Jun. and John Britton.
[6] Malcolm's Londinium Redivivum, Vol. 1.
[7] Knight's London.

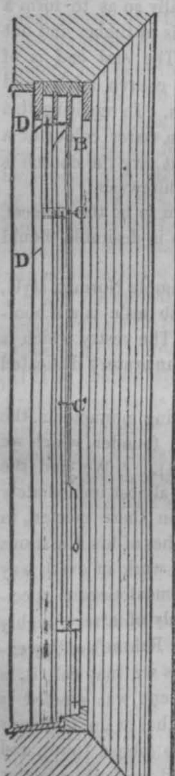
WINDOW FOR A LUNATIC ASYLUM.

Sir—The humane treatment recently observed towards unfortunate individuals labouring under the affliction of lunacy, rendered it necessary that extensive alterations should be made in the establishments provided for their reception, and in consequence, architects were invited to send suggestions for the improvements of St. Patrick's Hospital, (Swift's,) in this city, and then submitted by me, were approved. The most important arrangement was the window, in which it was indispensable to obtain strength and proper ventilation, without having any appearance of confinement, and if possible produce an elegant and cheerful effect, proper provision being made for the easy repair of them when requisite. In all these I succeeded, and as many of your readers may be called upon to make similar alterations, my suggestions may be of service; if you think so, I have sent you herewith a plan, elevation and section of the window, to which you can give publicity. I may observe, that I should have preferred having the window a little wider, but did not think it prudent to disturb the old arches, the windows being numerous, thirty-one in each corridor, in a length of 300 feet.

I have the honour to be,
Sir,
Your obedient servant,
Henry Hart, Architect.

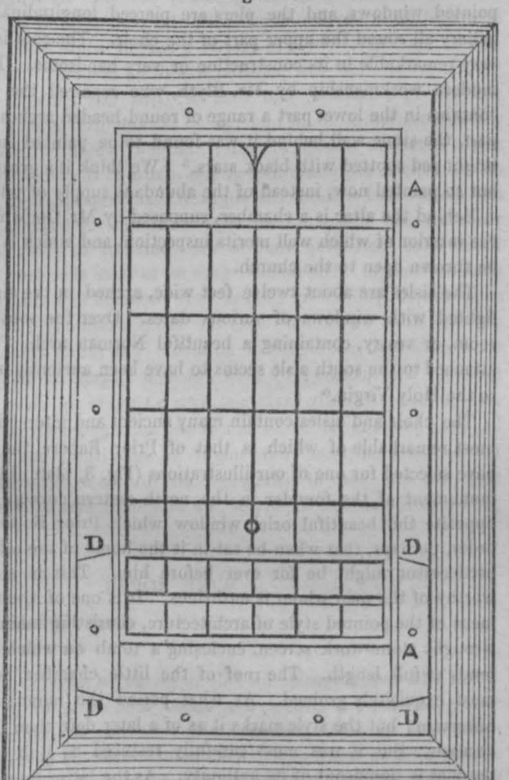
86, *Talbot Street, Dublin.*

Fig. 1.



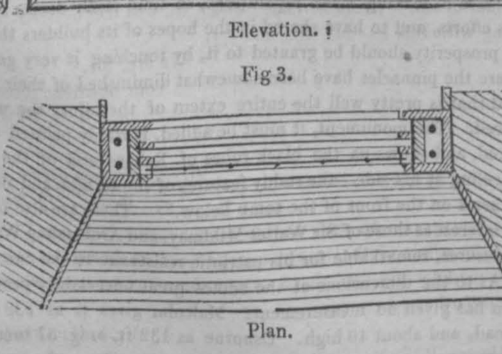
Section.

Fig 2.



Elevation.

Fig 3.



Plan.

Description.

The sashes are made of cast iron $1\frac{1}{4}$ inches thick, fixed in Memel frames in three parts, the centre one being immoveable; the top and bottom sashes are hung separately, are each 12 inches deep, and allowed to open to the extent of 6 inches only, stops being fixed upon the frames to prevent their opening wider. The pullies are placed above and below the opening points, A A, Fig. 2, of the sashes, so that no ropes are perceptible; small rollers are placed on the sashes to assist the action and to obviate the cross binding, which frequently takes place in small sashes. A bracket is cast to the top sash, through which a rod is placed, by which means the sash is opened, B, in Fig. 1; and to ensure a perpendicular pull, eyes are cast on the centre sash through which the rod passes, C C, Fig. 1. The rod is cranked at the bottom to give freedom to the hand. The frames are made of $1\frac{1}{2}$ Memel, and screwed together. Fixings, D D, Fig. 2, being left at the bottom to get at the weights, and on the outside at the top, D D, Fig. 1, to remove the upper sash, thus facility is given for immediate repair should it be required. The old windows were casements with large square mullions; the sashes contained each six squares, 6 inches wide and 10 deep. Perpendicular iron bars were placed one to each light, and the windows being placed very high in walls two feet six inches thick, very little light was admitted, and the corridors had a very gloomy appearance, they now present a cheerful aspect, and form an elegant promenade. The cost of each window, including the cutting of the openings, was about 4*l*.

ON THE ADVANTAGES OF EXTENDING INLAND STEAM NAVIGATION IN INDIA.

India presents to the civil engineer and architect of this country an almost illimitable field of action, and an interminable source of honourable and profitable employment. Its rivers, among the largest and noblest of the world, and coursing plains redolent with all that life can require, are rendered inutile and sometimes altogether valueless from the want of steam vessels and boats suitable to their traffic. Its plains are impassable from the want of roads; its roads and nullahs are useless from the want of bridges; its mines are useless from the want of talent to conduct them; its best manufactured products are lost to the home market from the want of skill and machinery; and, in fact, in every department of agriculture, manufacture, and commerce, the want of European talent and of the appliances of steam and steam engines, railroads, foundries, and clever men to conduct them, is most distressingly felt throughout India.

We have acquired by our arms another portion of this vast country, to which Great Britain, in fertility and extent, cannot be compared; and with this acquisition additional inducements are held out to talent—additional incitements to industry, on the expansive waters of the Indus, and the vast plains which derive their extraordinary fertility from the presence of that river: talent to direct the construction of suitable vessels, to open internal communication, and to introduce the European arts and machinery, in order to enhance the value of the rich and varied products of the earth. The country traversed by the Ganges and its chief tributary, the Jumna, contains upwards of 60,000,000 inhabitants: it is intersected with navigable streams, and the traffic, which is already very great, is annually increasing, as the arts and manufactures of Europe become justly appreciated by the natives. We are informed by Mr. Bell that the produce of the interior, in 1836-7, amounted to 179,458 tons, valued at £6,327,995; and it is presumed that returns to at least an equal amount were made in goods or specie: the annual traffic on the Ganges may therefore be rated at more than 12,500,000 sterling. A great portion of the trade is carried on by native boats dragged up the river by human beings, a tedious, expensive, and unsafe mode of conveyance, rendered still more so from the vilely-constructed boats and dogged indifference of their crews. Of steam boats, so essential to the free intercourse of Europeans in this country, and so much desired by the natives, there are six only, which start at intervals of three weeks from Calcutta and Allahabad. These steam boats belong to the Bengal government, and are employed principally for the transport of troops and stores, their extra tonnage being disposed of by public auction in Calcutta; and on the 6th April, 1841, the exorbitant price of £24 was paid by those who chose this most expensive mode of transit of their goods. This fact alone speaks volumes in favour of an extension of inland steam navigation by members of the community of this country; for the great competition of European and native merchants which leads them to pay this extraordinary price, is a convincing proof how much the extension of this mode of transit is required, and how exceedingly profitable it would prove at half the above rates, to those who chose to introduce them in numbers suitable to the demands of the market.

The transit of passengers by the steam boats on the Ganges has lately become of great magnitude; and by this mode the interchange with Calcutta and the great cities on the Ganges, Moorshedabad, Patna, Guazepoor, Benares, and Allahabad on the Jumna, is found to be, even at the present high rates, the most economical, as it is the most speedy. The natives of India, as well as the European merchants and residents in Calcutta and in the interior, are extremely desirous to adopt these as well as other European improvements; and it appears extraordinary that, in the depressed state of the iron trade at home, capitalists have not been found to supply the requisite number of steam tugs and flat-bottomed vessels of iron fitted for navigating these rivers in all seasons of the year, as well as for manufacturing machinery, which is at all times in demand. For it must be borne in mind that, although India possesses some of the richest iron mines in the world, she has neither miners to work them, nor foundries to manufacture the prepared material; it is, therefore, to England alone she must of necessity look for her supply of machinery and wrought iron.

The extent of traffic on the Indus is not so much known to us. Dr. Burns, speaking of the advantages of opening a commercial intercourse with Scinde proper, says, "Although the miserable poverty of the people of Scinde forbids the hope of mercantile interchanges to any extent with them, yet the natural advantages of the country for commerce need scarcely be pointed out; security to trade and property is alone required to render the Indus the medium of introducing our manufactures among vast nations, which, occupying climates resembling our native land, would gladly welcome the products of British industry, and offer to the speculations of our ingenious and enterprising countrymen ample encouragement and reward." In the preface to his interesting narrative he observes, "In the end of 1835, Messrs. Heddle and Wood had the gratification of exhibiting to the astonished natives of Hydrabad the first steam boat that ever entered the Indus. Vessels laden with rich wares from Bombay and Moultan. have now hailed each other on ts waters, and while bazaars of Western India are already teeming with the shawls of Cashmere, and the products of the Punjaub, received by the long forbidden route, not only for private speculators, but in large investments rom Maharaja Runjeet Singh himself."

There is abundance of coal in the several districts of Bengal, and in lieu of coal, on the banks of the Indus, the "jewur," a species of wood abounds, which, in the absence of coal, is found to be an excellent substitute; there is little doubt that coal will eventually be found in some of the extensive valleys of this river.

An estimate of the expense of steam boats tells us that each iron steam boat, with engines of 100 H.P. including freight from England, and expences of putting together in Calcutta, with wood work complete, costs £12,000; an iron flat (accommodation boat) capable of carrying 100 tons of goods and 30 passengers, £3000; the total expense being £15,000; the profits may be fairly estimated at 20 per cent.

It is to be hoped that the rivers of India, like those of America, will, in a few fleeting years, abound with these most useful auxiliaries to man's happiness; and that with increased facilities of communication, corresponding improvements will take place in the cultivation and manufacture of the staple commodities of this country. Articles, such as cotton and sugar, which to us have now become essential necessaries of life, and for the supplies of which we have at present to depend upon foreigners, are but little valued at home in comparison to the same kinds of produce coming from foreign countries, simply because due attention has not been paid to their culture and manufacture; and although some slight efforts have been made by the East India directors to introduce a better order of things, and some few Europeans have embarked their capital for the same laudable purpose, yet, comparatively speaking, little or nothing has been done; nor can we hope for much until the means of communication from one part of this vast continent to the other have become more extended—until many of the fine old, ancient roads are reopened and new roads are formed—until aqueducts, viaducts, and bridges are built, steam boats crowd the broad, expansive rivers, mines are opened, and foundries and factories are erected: all these objects may be gradually attained by the employment of British talent, capital, and enterprise, thereby increasing our own riches and prosperity, and at the same time administering more immediately to the wants and desires of 150,000,000 of inhabitants of India, who, as fellow-subjects, have a right to demand thus much of the inhabitants of Great Britain—of that country which, for two centuries past, has used its wealth, and diminished its internal resources.

TO PREVENT DAMP PENETRATING THROUGH WALLS.

SOME distinguished French chemists have lately directed their attention to the means of excluding damp from the internal surface of walls. The following is a translation of some observations on the subject by M. M. Thénard and D'Arcet. The experiments made by them were begun in 1813, when M. Gros undertook to paint the cupola of the church of St. Geneviève (then called the Pantheon). "The surface of the cupola had been previously prepared like a primed cloth: after the stone had received a coat of strong size, a ground of white lead and drying oil had been superadded." Fearing that this priming was not sufficiently firm, M. Gros came to consult us. We did not hesitate to say it was far from safe. The moisture might in time, we observed, act on the size, and a painting executed on such a ground would consequently change. We came to the couclusion, that it would be necessary first to saturate the stone as deeply as possible with an unctuous substance, liquified by heat, and which, solidifying as it cooled, would stop up the pores of the stone. We were strengthened in this view by the authority of the ancients, who sometimes passed melted wax over the surface of the walls which they intended to paint, and we were induced to try a coating of wax and linseed oil, rendered drying by litharge. "After some experiments on stones similar to those of the cupola, we were led to prefer a composition, consisting of one part wax and three parts oil boiled with one tenth of its weight of litharge. The absorption took place readily by means of heat, and the liquid penetrated the stone to the depth of from a quarter to half an inch. The composition as it cooled acquired solidity, and in six weeks or two months became hard. Having made these experiments, we proposed to adopt the same means on the cupola, and the operation was to be conducted as follows. The surface was first to be scraped, so as to entirely remove the paint and size, and lay the wall bare, then by means of a portable furnace, the whole superficies was to be heated, about a square yard at a time, and the composition was to be applied at a temperature of 100°, with large brushes. The first application being absorbed, a second was to be added, and so on till the stone should cease to absorb. To promote the absorption the stone was to be warmed repeatedly according to its porousness. In every case the heat ought to be as great as possible, but not so as to carbonize the oil. At length the stone being saturated to a certain depth with the composition, and the surface being smooth and dry, it was to receive a coat of white lead mixed with oil; and on this preparation the painting was to be executed. Our plan was adopted and put in execution, and thus M. Gros was enabled to produce a new masterwork which could undergo no change, except that which light and air might occasion. Drops of water like dew, which covered the whole surface of the cupola, every morning at first alarmed the artist; the drops appeared and disappeared without the slightest bad consequence, and a trial of 15 years has now dissipated all apprehension." A letter is then inserted from Baron Gros, certifying that in the course of 15 years his work had undergone no change. The memoir goes on to state that four pendentives in the same church, painted by Gèrard, were prepared in a similar manner. In this case the stone was so hard that the composition could not be made to penetrate more than one eighth of an inch. The result was however quite satisfactory. The painting by Gros was first begun, as before stated, in 1813, and has been recently examined with a view to its state of preservation; it has been pronounced to be in a sound and apparently unchanged condition. For ordinary purposes resin might be substituted for wax, the ingredients then are one part of lithargized oil to two or three parts of resin. (Appendix to the second Report of the Commissioners of the Fine Arts.)

WIRE ROPES.

Seam Wire Rope Works,
Gateshead, 28th Sept., 1843.

SIR—In your magazine for July in giving an account of the launch of the "Great Britain" at Bristol, it is stated that she is to be rigged with *wire ropes* made by a Mr. Andrew Smith; we beg to inform you that the wire rigging used on board of her was manufactured by us some time previous to her launch, and beg to annex a copy of a note from T. R. Guppy, Esq., the builder of the "Great Britain," which we will feel obliged by your inserting along with this in your next number.

We are, Sir,
Your obedient servants,
R. S. NEWALL & Co.

Great Western Steam Ship Works,
Bristol, 5th September, 1843.

GENTLEMEN—In reply to your favour of the 2nd inst. I beg to inform you that the whole of the iron wire rope used on board the Great Britain is of your manufacture, and that I decided on adopting it after testing its strength against other specimens.

I am, Gentlemen,
Your obedient servant
THOS. R. GUPPY.

Messrs. R. S. Newall & Co.
Gateshead.

THE PHILOSOPHY OF CORAL FORMATIONS, AND THEIR ARCHITECTS.

No. II.

According to the doctrine of the Pythagoreans and Platonists, there is life in all things, the living principle being omnipresent and inseparable from matter, regulating, modulating, and reconciling the various actions and parts of this mundane system. This living principle is the electric fluid of modern philosophers, being equally manifest in the living, the fossil and mineral kingdoms, giving form and properties to all: thus plants are distinguished from minerals only from their flexile nature, which enables them to multiply their parts and quantities to a certain extent without impeding the action of the living principle: the line of division of the animal, the vegetable and the mineral, is *life*, the link of life being one unbroken chain, commencing with the, to us, invisible point, and ending in the beautifully complicated mechanism of man: life in all being a measure of quantities and a measure of motions, continually varying, and finally dissolved. The great inherent property of organic life is to condense the elements, and to unite them in fixed and definite proportions within the body as animal and vegetable matter, which on the cessation of living action, becomes under many new combinations, fossil and mineral matter. The living and the dead are bound by the same chain of necessity for the preservation of form and quantity, and for the capacities, qualities, and powers which they severally develop, cause depending upon cause, effect depending upon effect.

In the lowest development of life, plants and animals closely approximate to each other in external character, the animal assuming the plant-like form, and multiplying by involuntary action, as is manifest in millepores, sponges, tubipora, and some species of coralline, and from thence distinguishable from vegetable species by voluntary action. In these orders and in monas, the line of demarcation as established by naturalists is removed; the zoophytes increasing by the vegetative process, their growth being perpendicular to the plane of position, although not invariably so, for many species of coralline have root, stem, and branch, the root increasing with the increase of the superstructure. As life advances in the scale of organization, so the distinction becomes apparent, until it becomes strongly defined, every advance in the organical structure being indicated by the development of organs peculiar to the animal, and explanatory of its habits and character.

Linnæus observes, "all calcareous substances are most truly of animal production; therefore corallines consisting of that substance do certainly belong to the animal kingdom:" but even admitting this to be true, it offers very little assistance to us, when we attempt to classify oceanic animal and vegetable life, as exhibited in the numerous species of naked polyps and sea weeds. On the other hand, it requires no very great stretch of imagination to suppose that plants having great absorbent powers and disposed very often on a calcareous soil, or otherwise in waters holding in suspension carbonate of lime, should receive and retain within their system or become enveloped with a crust of this material.

Mr. Ellis, demonstrating the animal nature of corallines, tells us that the softer and harder parts of zoophytes are so closely connected with one another, that they cannot separately exist, being constituent parts of the same body, the polype-like suckers being so many mouths thereto. This is correct, as regards species having these suckers, and is equally applicable to many of the stony corals, the suckers being the seat of sensation and voluntary action of all that part of the calcareous base which admits of the ingress and egress of the circulating fluid. The branchiform corals have their suckers disposed at the extremity of the branches and offshoots, and through these alone the whole body receives its nutriment, and by their expanding and contracting action and conducting powers of heat, the descent and ascent of the circulating juices is regulated. The cellular cavities covering the main trunk and branches lined with a membraneous substance bear no similitude to the suckers disposed at the extremities, nor do they perform the like duties, but similate more to the respiratory vessels of plants, gradually diminishing in size, and eventually when the entire form is developed, closing altogether, leaving the trunk still accessible in all its parts, until the whole lower portion consolidates, or it becomes entombed by increasing generations. It is certainly a mistaken notion that every cell throughout the body is the habitation of a polyp, for while we admit that animal matter pervades the whole body, we can only admit it to be one body in entirety, increasing and propagating through the instrumentality of its suckers which perform the active duties, conducting the food into the main trunk and branches, wherein it is elaborated into lime, gelatine, oil, phosphorus, and other peculiar compounds, the body fixed and immoveable being the passive medium of action, and receiving increasing size and solidity from continued accession of elaborated matters.

Ehrenberg tells us that tripoli, chalk, and other substances, when microscopically examined, display a cellular structure, the tenanted and untenanted habitations of polypidoms; and that every cell is undoubtedly the habitation of a polyp living, maturing and generating, independent of those connected with it. The radiate corals are of compound animal formation, the several tentaculæ or suckers being one body, united at the base, and governed by the one impulse; thus it is their growth is uniform and their form defined. Each of these suckers forms during the period of its growth a series of cells or joints, which communicating with the main body, accelerate the general increase of the whole, and enable the polyp to withstand more effectually outward influences, and to propagate its species: the branched madrepores are as previously observed, of plant-like growth, covered with cylindrical turbinate pores, the whole compound body being one, and uniformly governed by one impulse.

The polypous animal like the plant is the unconscious architect of its own existence, both advance in the line of light and heat, and ramify into shoots and branches according to their cellular composition and structure, both are the unconscious agents of production and reproduction of peculiar elementary compounds, and both perform an equally important part in the economy of nature.

The very recent report of Mr. Edward Forbes on the Mollusca and Radiata of the Ægean Sea, drawn up at the request of the British Association, confirms in a most remarkable manner the laws I have laid down as regulating oceanic animal and vegetable life, in disposition, quantities, and qualities illustrating the progressive development of species, habit and character, and consequently the gradual development of the fossil and mineral kingdoms He observes, that in eight distinct regions of depth, each presents its peculiar association of species defined between 0 and 230 fathoms; the most superficial of these, although the least extensive, having a depth of only two fathoms, being most prolific of animal and vegetable life, and most various in mineral character. The second region ranges from 2 to 10 fathoms, the third from 10 to 20, the fourth from 20 to 35, the fifth from 35 to 55, the sixth from 55 to 75, the seventh from 75 to 105, the eighth exceeding in extent all the others combined, ranging from 105 to the lowest depths explored, and presenting a uniform mineral character throughout and peculiar fauna. Certain species were found to range through several of these zones, and two through all. *It was found to be a law, that the extent of range of a species is correspondent with the extent of its geographical distribution.* On the other hand, species having a very limited range in depth were found to be either peculiar Mediterranean forms, or such as are extremely rare in the Ægean, but abundant in more northern seas. The testacea of the Ægean are for the most part dwarfs, as compared with their analogues in the ocean, and the number of medusæ and zoophytes are comparatively small. Below the fourth region in depth the number of animals diminishes as we descend, until, *in the lowest part of the eighth region the number of testacea was found to be only eight.* In the upper regions the more southern forms prevailed, whilst those of the lower zones presented a northern character, *indicating a probable law*, that in the distribution of marine animals, *regions of depths are equivalent to parallels of latitude.* A corresponding succession and replacement of forms by similar forms was discovered in depth. Each species attains a maximum in development of individuals, and gradually diminishes in numbers as we descend; but before its disappearance in many genera, a representative species commences, attaining a maximum after the disappearance of its predecessor, and then in like manner, diminishing to a minimum and disappearing. Genera are in like manner, represented and replaced by corresponding genera. This is equally true with vegetables as with animals. Green fuci were found as deep as 55 fathoms, and millepora extends its range to 105 fathoms.

Within the waters of the Pacific Ocean several hundred thousand square miles of habitable land have been formed or are now forming, through the agency of gelatinous and lime-secreting polyps, aided by innumerable families of shell fish, marine plants, and locomotive animals with which the waters abound. Hills and chains of hills, mountains and mountain chains, running alone the tidal lines gradually enlarge their summits as these waters decrease, and for upwards of 4000 miles not a single island occurs that is not of coral formation. The great reef on the coast of New Holland extends its uninterrupted course 350 miles, and forms a continuous line with others to the extent of 1000 miles, varying in breadth from 20 to 50 miles: the lower plains of the vast continent of Australia have the like origin, and throughout the whole Australian seas there is scarcely one league without a coral reef, rock, or island, raised from the lower depths by polypous animals, though close to within the reef the sea is fathomless: thus the whole extent of this portion of the ocean is rapidly filling up, and the main continent continually enlarges its geographical area.

In the south sea, particularly to the eastward of the Friendly Islands, from the 10th to the 15th latitude, a reef of coral surrounds the island of Otaheite rising like a wall from unfathomable depths. Palmerston island, the islands of Tanea, Middleburgh, Tongataboo, Magea, and numberless islands of the South Sea and Pacific Ocean are of like formations. The coral reefs and islands called the Maldives form a chain of 480 geographical miles in length, running due north and south. The whole line of coast of Eastern Africa, the island of Madagascar, and other islands scattered over the

Indian Ocean, owe their origin and increase to like causes. The islands of the West Indies and vast barriers on the shores of the main land are coralline—the Persian Gulf and the whole of the Red Sea are both rapidly filling up, the latter sea being at present barely navigable by vessels of large burthen through a very narrow channel, and by far the greater portion of the main continent of Africa and of Asia, including all the great deserts and mountain chains intersecting them in various directions. Charles T. Bell supposes the advance of land upon the gulf of Persia to be more than 280 miles since the last catastrophe; and all writers unite with him in supposing that great encroachments have, and continually are taking place in these latitudes. The clay of the Euphrates contains an excess of sodium, and on either side are immense deserts of sand, salt, bitumen, naphtha, magnesia, soda, and calcareous matter, while the hill chains dividing them, are wholly composed of matters almost exclusively oceanic. At Cutch and the whole of the northern shores of India, the land has encroached upon the sea to a vast extent; the great Run, 7000 square miles in extent, is one sandy flat containing vast beds of salt, and the elevated tracks surrounding it demonstrate their origin. The great deserts of Africa, Zaharah, Nubia, Lybia, Egypt, Mesopotamia, and many others, stretching from the Atlantic through Asia, are exclusively oceanic, the entire soil being sands and calcareous matters, beds and hills of salt, chains of hills composed wholly of corals, balani, oysters, and numerous species of shell fish, interspersed with vast accumulations of petrifactions, and the skeleton remains of fishes. Approaching towards Europe the like phenomena have been noticed so far back as the time of Diodorus, Pliny, and Strabo: further proofs of the decrease of the waters are afforded, by the fact of the drying off of large inlaid seas, thus the communication between the Caspian and the Black Sea, the Red Sea and the Mediterranean, have been broken off, and the vast salt lakes of Russia are standing and incontestible memorials of the seas retreating therefrom.

The Red Sea is most abundantly stored with coral formations, lime secreting animals, fishes, animalculæ and sea weeds: the vast shallows embracing full three-fourths of its entire surface present to the eye of the naturalist the stupendous workings of nature, and the primary causes of many effects manifest in terrestrial earth. Sailing over them during the long continued calms common to this sea, when not a ripple disturbs the surface of the waters, which are bright and blue as the lake of Como, the eye is delighted with the panoramic view beneath. Gardens abounding with animal flowers of every hue, the red pipe coral, green meandrina, black gorgania, and sponge, purple, blue, yellow, white and brown madrepores and millepores interspersed in clumps and groups with corallines and plants of the most delicate texture. Plains covered with green verdure tenanted by crustacea, turtles and fishes, valleys covered with a white sand, partially hidden from the view by wings, murices, sea eggs, sea snails, pens, star fish, and scarlet, soldier and hermit crabs—elevated plateaux of pearl oysters—hills of cirrhipedes, and chains of hills of reef coral, whose towering summits sometimes resemble the roofs of palaces and temples of the richest and most elaborate workmanship, from which pedunculated cirrhipedes and purple mussels are hanging in clusters, while beneath, wide and magnificent portals open into caves of beautiful coral, where the coral fish resplendent in azure and silver, and green and gold, resort in numbers for their delicate food, cropping the equally gaudy animal flower from its living bud. Above, the sea teams with its living myriads of phosphorescent animalculæ, sharks, bonetas, dolphins, black fish, medusæ, and numerous other species.

The calcareous matter covering the valleys and troughs is analogous to the chalk deposits of the earth, consisting of the atomic particles, entire bodies, and portions of bodies of generation upon generation mixed with the digested matter continually deposited by the living. The sands vary in their nature and quantities, in localities being extremely fine, when formed by the death and decomposition of young mollusca, which are thrown up in vast abundance on some of the shores near which they are deposited by the parent; and much coarser when they are produced by the decomposition of murices, oysters, gigantic cockles, and other shell fish having heavy calcareous shells. The outward reefs towards the ocean are invariably consolidated, consisting of the reef coral and various lime-secreting species enveloped in consolidated rising formation; the reefs always form along the tidal line, and when the rising structure causes the tide to diverge right or left, then, within the disturbed space the zoophytes cease to work, and an opening is left of considerable width and depth, of much advantage to mariners, who are thereby enabled to take refuge within the reefs during stormy weather. This outer reef presents a perpendicular wall to the tidal currents, but generally has a gentle inclination towards shores with two or more parallel chains, thus from Mocha to Yambo there is a continuous reef, and for upwards of 500 miles a triple chain of reefs is seen running parallel to the coast, and to the mountain chains of Arabia bordering the sea. The inner reefs are variably composed, their elevated parts being generally of the like conformation of the outer wall, but the interior is sometimes filled by coral banks heaped up by storms, consisting of broken coral sands and weeds; upon these, in the long continued calms common to this sea, vast multitudes of mollusca resort, which are buried in the next periodical disturbance, thus stratum upon stratum is formed, until the bank tops the water, sometimes cutting off vast tracks from the main ocean, which, when perfectly isolated, soon become a portion of the desert. The reef is sometimes formed by the united labours of numerous species of lime-secreting animals, separately working in groups and families, or confusedly blending together and embracing each other in the general ruin, the coral polyps enveloping all the crustaceæ and corallines, and the relics of the dead in their stony folds. Many entire hills are formed by particular families, such as serpula contortuplicata, balani, and white tube coral, and others are wholly formed of calcareous matters or sea weed, the whole united mass being one vast receptacle of the dead, and so long as covered by the waters, one general birth place of the living: the like phenomena of coral formations is common to all tropical seas.

Mr. Dalrymple, who first drew attention to this important subject, observes, that in the eastern seas, coral banks grow by a quick progression towards the surface; but the winds heaping up the coral from deeper water, chiefly accelerate their formation into shoals and islands. They become gradually shallower; and when once the sea meets with resistance, the coral is quickly thrown up by the force of the power breaking against the bank; and hence it is that in the open sea, there is scarce an instance of a coral bank having so little water, that a large ship cannot pass over it, but it is also so shallow that a ship would ground on it. The coral banks were observed by him in all stages of growth, some in deep water, others with few rocks appearing above the surface, some just formed into islands, and others covered with land vegetation. Bars of sand and coral also form, cutting off large portions of the waters, the isolated portion being soon filled up by this material. The violence of the waves, he observes, gives the direction and form to the reefs, which are long and narrow; but when not exposed to the common monsoon they assume irregular forms, according to the accident of circumstances. Such in truth is the origin of many coral banks; but this mode of formation cannot apply to those barrier reefs and rock built islands which constitute the by far greater portion of coral formations. It is true that all reefs receive increase by continued sedimentary depositions; but many of the inner reefs of seas being beyond the action of the storms, are entirely built up by the living architects, without the aid of broken coral and sands from deeper waters: thus all navigators speak of these enormous barriers and local accumulations as presenting seaward a solid wall of limestone of unfathomable depth, and such could not be the case were they built up by the sands and broken coral alone.

The analogous formations intersecting the earth in hill and mountain chains of limestone, oolite and chalk, give correct ideas of the disposition and shape of these reefs now forming within tropical seas; the limestone has invariably one or more perpendicular faces, the same inclination pervading the reef, the extreme height not exceeding 4000 feet: the chalk having also occasionally one abrupt face, but being in many instances dome shaped; the larger formations generally running for a considerable distance in a direct line, the smaller being grouped together, being as evidenced by their organic remains formed in the shallows of warm and tranquil seas.

The Red Sea, as previously observed, is literally choked up with coral reefs, sands, and embankments, composed of broken corals, shell fish, &c.; and the lower depths are also rapidly filling up with the finer decomposed particles of lime secreting animals, fuci and other organic remains; since the days of the Pharoahs, thousands of square miles have been abstracted from this sea, from the Persian Gulf, and hundreds of islands have reared their crests far above the surface of the waters. Sea port towns once accessible to vessels of heavy burthen, are now lost in the distant desert plain, or are inapproachable for miles. Ehrenberg tells us that the ancient harbours are filled up with the debris washed into them by storms, but this is not the fact; the present site of Yambo is on a recent coral reef, from which the inhabitants say the waters are continually receding. Djeddah is inapproachable by our vessels for two or three miles, the solid coral limestone rock approaching in all parts of this intervening space to the very surface of the waters, and Lohheih, the great coffee mart, once a well frequented port, is inapproachable for full five miles; the coast on the Arabian side is bounded by continuous reefs of recent coral, now standing from 20 to 60 feet above high water mark, and chains of lakes are formed both by this general decrease of the waters, and also by accumulating sand banks. Beds of pearl oysters, and hills of peculiar species of lime-secreting animals common to this sea, may be found many miles inland. The accumulations of coral, sand, and calcareous matter are of incredible extent and thickness, embracing many thousand square miles between the sea and the hills of Arabia and Africa. Few of the islands are or can be inhabited, being desert soil, wholly devoid of vegetation, with the exception of the amphibious mangrove, and a few stunted shrubs and coarse grasses, and such plants that love a barren acrid soil: they are the resort of pelicans and other sea birds, whose dung sometimes covers the surface to a considerable extent. In consequence of the want of rain, these islands continue bare and desolate from generation to generation.

The phenomena of coral reefs similate in all parts of the ocean where they are produced, but the after changes which take place on their surface depend on the nature of the latitude under which they are disposed. As in the Red Sea, in the absence of rain, we find them for ever desolate; so in the Pacific and Southern oceans, where the rains are frequent, the surface soil of the islands soon acquires aptitude and power to produce vegetables, and to sustain animal life, the acrid salts and other organical compounds being washed into the waters or into the bowels of the earth, where they have united with the free alkalies: thus the island no sooner tops the wave, than the cocoa nut and other tropical plants cover its surface. In and throughout the whole, the coral formations originate from similar causes in action, the lower depths of the ocean fill up with sands, fuci, and naked polyps, upon this basis the calcareous polyp builds, assisted in its labours by numerous species of mollusca, and furnished with material by the myriads of creatures living and in death decomposing in the medium in which they are placed. Upon the ruins of preceding existencies conchifera and mollusca dispose themselves in groups and families, or are heterogenously united with the general body, adding during the whole period of their existence and by their death to the soil, and similating to the general body their elementary constituents, contributing to form the one great whole, or general sum of earthy matter. Donati speaks of the bed of the Mediterranean being filled up to the depth of 800 feet with the calcareous bodies of the dead: what then must be the depths of these deposits in tropical seas where species are infinitely more numerous and diversified, and where lime-secreting polyps build from depths unfathomable, filling up a geographical range many times larger than the Mediterranean Sea.

Nor is it to the coral polyps alone that we are indebted for the formation of islands and continents of the earth. Many localities of the deep are overspread in vast patches with fuci, which as they generate, contribute to fill up the void of waters by administering to the wants of numerous finny tribes resorting to these submarine meadows, and by contributing to the digestive process of those fishes, and, also in decomposition of their parts adding thereto. Again, the fecundity of many species is most amazingly great, and were it not for the eternal warfare waged against each other, and the numerous accidents to which they are subject, the whole ocean would speedily become corrupt with the living of the dead: thus we are told that in the ovula of a flounder of 2 oz. weight have been counted 133,407 eggs; in one of 24 oz. 1,357,400; herrings weighing from 4 to 5 oz. from 21,285 to 36,960; lobsters from 14 to 36 oz. 21,699; mackerel of 20 oz. 454,967; sturgeon of 160 lb. nearly 1,500,000; cod fish are supposed to spawn annually 9,000,000, and ling 19,248,625. Leuhenhoeck also tells us that a globular body of one inch diameter of oyster liquor may contain 1,728,000 embryo oysters, besides animalculæ, 500 times less than the spawn. The crustacea are all exceedingly prolific, and advance rapidly to maturity, and in warm tranquil seas the several varieties of shell fish are strikingly abundant; while throughout the aqueous medium fishes, animalculæ, medusæ, and other locomotive animals abound, and in their abundance contribute to fill up the valleys of the deep, and to raise the submarine hills and mountains to the surface of that element to which their operations are confined. Other causes in action contribute to the ultimate result, the waters slowly disappear, and the virgin soil which, from its base to its summit, as composed of the reliquæ of the dead, becomes exposed to new influences, whereby its future character is determined.

The number and variety of living species inhabiting the ocean, and by the functional operations of life contributing to increase the consolidated matter termed earth, is far beyond the imagination of man, and every species, from monas to the monster mammalia, derive their elementary constituents from the medium in which they move, abstracting matter from the atmosphere and from the waters, and maintaining form and characteristic properties through the agency of light, heat, and electricity, becoming wholly or partly in death a portion of the soil, and of those peculiar compounds generally disseminated through the waters. Of the food received within the living system nothing is lost, one portion adds by secretion to the rising strength and maturity of the body, and to the propagation of kind, and from thence to decay, the remainder passing out by excretion or respiration; and as the nature of the aqueous medium and the elementary influences exercised therein determines the nature of the organic body, so does the nature of the body determine the nature of the organic compound generated by living action, and the sum of existence of species uniform in their parts and qualities determines the nature of the formation produced by their combined operations. The consolidated atomic quantities, or the entire animal frame may lose a portion of their elementary constituents, which volatilize and return to the primary state, or are disseminated through the waters; but every organic body performs in its degrees the general operation of converting the elements constituting air and water into consolidated matter, or into definite results, in which their previous combinations are dissolved and new creations are formed belonging to the class of undecompounded bodies.

Oceanic species are governed by the same laws of distribution as terrestrial species, habitude being absolutely and indispensably necessary for the existence of particular orders, and for the full organical development and accelerated growth of others. Coral formations like tropical forests flourish in analogous latitudes, and if removed from those latitudes, they quickly diverge into species by losing some of their characteristic properties, and if the change be in the extreme the order becomes extinct: thus the pearl oyster and other peculiar species of shell fish degenerate as they approach temperate regions, and many of the lime secreting polyps become divested of their calcareous clothing when removed from the direct influence of light and heat. All orders affect particular latitude, dip and inclination, and although many, from their peculiar formation, are enabled to resist and overcome the destroying influences of change, by adaptation of parts to that change, others, and perhaps the more numerous, are of necessity confined to particular latitudes. As living beings all are subject to the like vicissitudes, the one species, or the comminuted or consolidated parts of the many, being the accident of production of other species, the one contending with and devouring others, the tenure of existence being perpetual warfare, species against species, life against life; in death all unite in one vast social compact, the devourer and the devoured contributing unconsciously to accomplish the one vast magnificent end, *the ultimate perfection and maturity of this planetary body:* living, they produce by their chemical and mechanical action, animal and vegetable matters, earths, acids, gaseous and etherial fluids, all of which by the unceasing generation of living beings as continually increase; i death nothing is lost, groups and families uniting to themselves countless myriads, become the architects of beds, hills, and mountain chains, the finer particles of bodies contribute with the reliquæ of fishes to fill up the troughs and valleys with marl, the sands are formed into sand banks, the fuci accumulate in vast heaps, and uniting with calcareous matters pass into the mineral kingdom as schistose rock or peculiar clay, and every organic body contributes by its death to the formation of some one particular earth.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

May 16.—The PRESIDENT in the Chair.

"*Description of an improved form of the Journals of the Axles for Railways.*" By Captain Elias Robison Handcock.

The paper commences by enumerating the principal disadvantages of the common railway axles, noticing particularly, the great consumption of oil; the wear and tear, not only of the axles, but also of the boxes and the brasses; the oscillation occasioned by the wearing away in length of the latter, producing destructive effects alike to the engine, carriages and rails, as well as being disagreeable to the passengers. It then describes the new form of axle, which it is contended is calculated to remove these evils. The chief peculiarities of its form, consist in substituting for the abrupt shoulder at either end of the journal, two cones; the outer one, which is loose on the axle, is capable of being forced forward by a screw on the extremity; it is prevented from revolving on the journal by means of a tongue, and is secured by a screw nut, and key. The two anti-friction collars of hard brass, which take the places of the ordinary journal brasses, are about three-eighths of an inch in thickness, and are fitted on the journal sufficiently loose to enable them to turn freely in the bored cast-iron boxes which support them; these collars extend over both the cones and along the journal till their ends meet within about a quarter of an inch in the centre, and acting as an independent moveable power between the journal and the cast-iron box into which they are fitted, they reduce the amount of friction when it becomes greatest. Among the advantages derived from this new form, are the uniform smooth and steady motion, consequently reducing the wear and tear; allowing the collars to be at all times tightened, avoiding the lateral action, which is detrimental to the carriages, and to the line of rails; the smaller consumption of oil; one pound of oil being found sufficient to lubricate a six-wheeled engine and four-wheeled tender, while running a distance of nearly 1000 miles, and the absence of any tendency to heat. The paper concludes, by expatiating on the benefits already found by experience to result from their use.

Remarks.—Captain Handcock exhibited the journal of a common railway axle, with its box and brasses, which had been in use, and pointed out that the principal abrasion had taken place at the ends, that a new brass for the same journal would require to be nearly an inch longer, and therefore, that the oscillation of the carriage must necessarily be great, whenever the brasses began to wear. He explained that it was usual, in order to save the expense of new brasses, to weld an iron ring upon the journal against the collar, and showed one, which had worn such a cavity in the end of the brass, as to bury itself completely within it. It appeared also that there was much wear both on the journal and in the box, and that unless an axle possessed the means of having its brasses tightened up endways, oscillation and abrasion were inevitable. A journal and its cones of the improved form, which had run over 21,000 miles on the South-Western Railway, exhibited no visible amount of abrasion, and Captain Handcock contended that the practice confirmed his previous ideas.

Mr. Field thought the form of the axles a decided improvement. They were somewhat on the principal of those which had succeeded so well for common roads, and he believed that they must prove of considerable advantage for railways.

Mr. Fairbairn approved of the construction of the journals, and had no doubt of their practical efficiency; he particularly liked the cones, as in addition to their affording the means of preventing lateral motion and diminishing the friction, their form added strength to that point near the shoulder where it was most wanted.

Captain Handcock stated that the average consumption of oil on railways, was for an engine and tender with common axles and brasses, about 6 lb. for 110 miles; of this quantity, 2 lb. were used for lubricating the axles.

General Pasley observed that his attention had been drawn to these axles, and although on account of his official position, he scrupulously avoided giving any opinion on the merits or demerits of an invention, yet he might say that if he was a proprietor of a railway, such was his opinion of Captain Handcock's axles, that he certainly would give them a trial.

"*On the application of Zinc by the process of Electro-deposition, for the preservation of Iron, as applied to Engineering and other purposes.*" By Frederick Pellatt.

The object of the paper is to direct attention to the properties of zinc as a protecting coating for iron; to describe the processes already employed for that purpose; the reasons of their failure, and the peculiar fitness of the process of electro-deposition of metal for the purpose. Iron is, it is stated, from its superior affinity for oxygen, liable to rapid decomposition, and it has ever been a desideratum to discover some cheap mode of protecting it; the ordinary methods of painting and tinning not being sufficiently lasting. By the laws of electricity, when metals are in contact, the negative metal is protected at the expense of the positive: and under all ordinary circumstances zinc being the positive metal, it becomes a protector to the negative metal—iron. Zinc, like most metals in commerce, is not to be met with pure; in the other metals, however, the impurities do not generally tend to the injury of the metals with which they are combined; such, however, is not the case with zinc and its impurities, as when in contact with moisture, they generate a galvanic action by which the zinc is rapidly destroyed. Those who have made use of zinc, especially where it has been exposed to exciting fluids, such as milk, or any other fluid easily converted into acid, are well aware of the rapidity of its destruction. The impurities existing in ordinary zinc are then noticed, as well as the difficulty and costliness of the process of sublimation, in order to refine it. It is also contended that impure zinc being in itself so easily destructible, is of little value, as it cannot afford protection to any other metal which may be coated with it: and therefore the mode of plating iron with melted zinc (of commerce), must be objectionable.

The Report made to the French Academy by Monsieur Dumas, is quoted, in which he says: "the zincing of iron by steeping it in a bath of melted zinc, has many inconveniences: besides, the iron combining with the zinc, constitutes a very brittle superficial alloy, the iron losing its tenacity. The presence of foreign matters used in the process, in order to keep the zinc in fusion, increases the amount of impurity, and being less fusible than the zinc, a great loss is created in consequence of the zinc volatilizing at a high temperature. It is well known that in the deposition of metals from metallic salts by the electro-process, the pure metal only is deposited, so that the process described in the paper, is not open to the objections against ordinary metallic coatings. The iron also being coated with zinc in a cold solution, its state is in no way changed. The expense of the process is stated not to exceed that of four coats of oil paint.

Though to men of science the properties of zinc in connexion with other metals have been well known, (and the opinion of Drs. Graham, Kane, Daniel, and Monsieur Dumas, are quoted on the subject,) yet practically this knowledge has not been much applied, chiefly from the difficulty of obtaining pure zinc. The electro process, it is stated, entirely overcomes the difficulty; at the same time it affords facilities for covering iron-work of any form or size, and as it requires no great outlay, the process may be carried on in any locality. Zinc has another great advantage: although it is easily oxydized, the oxyde in ordinary circumstances is insoluble, and affords a protection to the metal below. For roofing and many other purposes, of which a long list is given, it is suggested that zinced iron would be found very useful.

Remarks.—Mr. F. Pellatt exhibited a number of specimens of iron covered with zinc and copper by the process of electro-deposition, which he described. The pieces of iron were first rendered perfectly clean and free from oxyde by plunging them into a bath of heated sulphuric acid and water: they were then placed in a cold solution of sulphate of zinc. The positive pole of a galvanic battery being attached to a zinc plate, and the negative pole to the piece intended to be covered with metal, the deposition commenced equally all over it, and was continued as long as was considered necessary. By this process the pure metal alone could be deposited, and the amalgamation of the zinc and iron, which occurred when the iron plates were dipped into melted metal, was avoided. For zincing, he preferred an acid to an alkaline solution of the metallic salts. Some thin plates, which had been exposed for eight months, on roofs in London, did not exhibit any appearance of rust. The process could be applied on any scale, as all the apparatus that was necessary was some wooden troughs to contain the solution and the pieces of metal to be covered. He had not made accurate experiments as to the efficacy of the process, when applied to iron exposed to the action of sea-water, but he feared the result, on account of the formation of muriate of zinc.

The President said the subject was one of great importance to engineers, as if the deposited coating was found to stand the test of time, it would enable the use of iron to be extended; but the main point to which he would direct Mr. Pellatt's attention was the defence of cast-iron from the destructive action of sea water.

May 28.—The PRESIDENT in the Chair.

"*Account of some Egyptian Bricks from the Pyramids of Dashoor.*" By J. Perring. Communicated by William Newton, Assoc. Inst. C. E.

The author states that the ancient Egyptians used bricks for every purpose, except for the erection of temples and tombs; that they were generally crude bricks dried in the sun, and in the dry climate of Egypt they sufficed for all ordinary purposes. The only instances in which he found they had been subjected to the action of fire, were for a quay-wall, and for the foundations of a town near the Nile in a damp situation. From the drawings in the tombs, and the narrative of Holy Writ, it would appear that the captives were generally employed in manufacturing bricks, and as many are found with the name of the reigning monarch stamped upon them, it is not improbable that they constituted a government monopoly. It is a curious fact in connexion with the Biblical account of the labours of the Jews, that more bricks bear the stamp of Thothmes III. than of any other monarch; and according to Wilkinson and other learned authors, it was during his reign that the exode of the Israelites took place.

The bricks, which are 16 in. long, 8 in. wide, and about 5 in. thick, are made of the alluvial soil of the valley of the Nile, mixed up with chopped straw to bind the whole together. They were formed in wooden moulds, and dried in the sun. It would appear from drawings, that the earth was tempered and the straw was mixed in, by men treading the mass with their feet. With such bricks as these the Egyptians formed the walls of their towns, using the alluvial earth also as mortar. The author states that he found some remarkably well-formed arches, of 12 ft. to 14 ft. span, built in concentric half-brick rings, at Thebes, the bricks of which were marked with the name of Sesostris; consequently they must have remained uninjured by time upwards of 3,180 years. They all have a cavity in the sides to retain the mortar, similar to what is practised in modern bricks.

The pyramid from whence these bricks were taken, was built, according to Herodotus, by a king named Asychis, who lived about 2000 years before the Christian era. The body of the pyramid is composed entirely of crude brick, but it had an external casing of limestone as a protection from the action of the weather. The author says that not a single brick appears to have settled from its place, and that it is difficult to imagine a mass more solid and compact, in spite of the great pressure the bricks had to support in a pyramid of 215 feet high.

Deposit in Pipes from a Brewery.

Mr. Davison presented a piece of copper pipe, 6 in. diameter, through which the wort had been forced during a considerable period, at Messrs. Truman, Hanbury, and Co.'s brewery. It was nearly stopped up by a deposit of a black substance, which opposed such resistance to the passage of the fluid as to induce an examination of the pipes, and the discovery of their state.

Dr. Ure said that the deposit was a good example of what Leibig called "Eremacausis"—product of slow combustion. The substance was a carbonaceous matter, resulting from the slow combustion of the gluten and starch contained in the brewers' worts.

May 30.—The PRESIDENT in the Chair.

CORROSION OF IRON AND STEEL.

"*On the action of Air and Water, whether fresh or salt, clear or foul, and at various temperatures, upon Cast and Wrought Iron, and Steel.*" By Robert Mallett, M. Inst. C. E.[1]

The author in this paper gives the completion of his researches upon this subject, on which he has been engaged for nearly five years, during the in-

[1] This paper, which forms the continuation of the communication which was read before the Institution, May 26, 1840, (Minutes of Proceedings, *Journal*, Vol. III., p. 424,) occupied the attention of the meetings on two eve ings.

tervals of professional avocations. The experiments, originally undertaken at the request of the British Association, had reference merely to the action of air and water on iron, in various states and under several conditions; but in the progress of research, the author has extended the investigation to many other connected branches of practical importance, such as the several modes, or assumed modes, of protecting iron from corrosion, in which he has proposed improved methods dependent upon known principles, which are developed at length, and which appear likely to be of great importance, in relation to the circumstances affecting the durability and corrosion, whether general or local, of iron ships, to which he has devoted much attention. The protective powers of various paints and varnishes have also been determined in many conditions, and the peculiar circumstances of corrosion presumed to attach to railways bars, are partially investigated.

The main numerical results of these investigations are given in two volumes of Tables, which show on inspection the absolute and relative losses by corrosion, in given times, and under six several conditions of experiments, on nearly all the various qualities of cast and wrought iron, and steel, made at the most important works in Great Britain. During the experiments, the metals were exposed at two several periods of 387 days, and of 732 days respectively, to the action of—

1. Clear sea water, at temp. 56° to 58° Fahrenheit.
2. Foul sea water „ ditto.
3. Clear sea water „ 110 to 125 ditto.
4. Clear river water „ 32 to 68 ditto.
5. Foul river water „ 36 to 61 ditto.
6. Freely exposed to the atmosphere, and its precipitations, at Dublin.

Tables are also given containing the amounts of corrosion of cast and wrought iron, in sea and fresh water.

1. When coated with zinc, or galvanically protected by its contact.
2. When painted and varnished in various ways.
3. When in contact with various definite alloys of copper and zinc, and of copper and tin, as in brass and gun metal, which are both electro-negative to iron in water.
4. Of cast iron, with the surface variously modified by the method of coating, as by chilling, &c., or with the surface or coat removed by planing.
5. Of the specific gravities, rigidly ascertained, of all the specimens of cast and wrought iron and steel, experimented on, and determinations, for the first time made, of the changes in density, produced by casting iron under a variable head of metal, and of the effects on density of changes in the mass or bulk of castings in iron; all which, the author has shown, affect the ratio of corrosion of a given sort of cast iron.

These tables, which the author intends to contain the chief information requisite for the engineer, to enable him in practice to allow for the loss of his structures by corrosion in any given time, and to choose the most desirable irons, &c., are followed by others, which condense into one view the whole results arrived at, and fit them for practical reference.[2]

Another principal object held in view in the tabulation of these results, and effected by the author, was by discussion of their contents to discover upon what variations in the texture, density or chemical constitutions of the metal, maximum and minimum corrodibility under given conditions depended; for this purpose numerous exact analyses of the cast and wrought iron, &c., of maxima and minima corrosion, became requisite. These have been made by the author, and are given in separate tables, together with the details of the methods adopted for obtaining correct results; a matter of admitted difficulty in the case of the analysis of iron.[3] These analyses show that corrodibility does not depend upon the proportion of constituent carbon in cast iron, and still less upon that of the other foreign matters usually found in it; but upon the state in which carbon exists in the compound; upon the state of aggregation of the whole mass; upon the density, and upon the voltaic uniformity, or otherwise, of the surfaces exposed to corrosion. Thus the same sort of cast iron corrodes much faster, in given conditions, if cooled irregularly, and faster than it does when cooled uniformly and slowly.

Hot or cold blast produces very little difference in corrodibility of cast iron, and this results chiefly from difference in density; recollecting that carbon exists in cast iron in two very different states, viz., as diffused graphite in a crystallized form, and as combined carbon; that the dark grey and softer irons contain more of the former, while the harder and brighter irons have more of the latter; that the latter kind have much less uniformity of surface, when cast under similar conditions, than the former; while the highly graphitic irons, though more uniform in large specimens, are the least dense and softest in texture—we arrive hence at the ultimate choice that the bright grey irons of high commercial value, while they are in all, other respects the most useful for construction, are also the most durable when exposed to the action of air and water. The second prolonged period of immersion of all the specimens was necessary, in order to determine the "law of progression of corrosion, with respect to time." The author finds that where the coat of oxyde and of carbonaceous matter or plumbago formed, is constantly removed from the surface of cast iron exposed to corrosion in air and water, the progression of the latter is a decreasing one, because as the metal is removed, the inner portions become more uniform in texture, and fewer minute voltaic couples are formed; but where the oxydes and plumbago remain untouched, these being both electro-negative to the metal, nearly equilibriate the effect of the regular texture; and thus the rate of corrosion remains uniform, or is nearly in direct proportion to the time of reaction. This is demonstrated experimentally, and is most forcibly exhibited in corrosion by sea water. Hence in practice, cast iron immersed without any protection, will corrode less if occasionally scraped and cleaned; or if in a tide-way, than if untouched and in still sea water.

The rate of corrosion, as dependent on the metal itself, is a minimum when the cast iron is most uniform and hard, and free from suspended graphite, and as dependent upon the water in which it is immersed; is a maximum in foul sea water, and a minimum in clear river water, both being at mean temperature, and containing nearly the same volumes of combined air and carbonic acid. The kyanized oak boxes, 2 in. in thickness, in which the specimens were immersed in Kingston Harbour, were eaten through in about two years by the *limnoria terebrans*. Cast iron freely exposed to the weather at Dublin, and to all its atmospheric precipitations, was corroded nearly as fast as if in clear sea water, when the specimens in both cases were wholly unprotected.

The results of experiments on wrought iron and steel, show that they consist of two or more different chemical compounds, coherent and interlaced, of which one is electro-negative to the other. The electro-positive body being that which suffers first from corrosion, the electro-negative portions of the iron and steel remain bright, and hold a perfect metallic lustre until the whole of the other portions are removed, or at least are so to a great depth, when they begin likewise to oxydate. In general the finer the quality of wrought iron, and the more perfectly uniform its texture, the slower and more uniform is its corrosion in water; minute differences in chemical constitution produce little change in this respect. Highly silicious wrought iron, however, corrodes very locally, and appears to be partially defended by a thin coat of silex formed on it. Fagoted scrap bars, made from best Staffordshire rivet iron, was found of all the irons experimented upon, to be the most durable; next to this was Low Moor boiler plate, and it is thence preferable for iron ship building. Foul sea water, evolving sulphuretted hydrogen, gives the maximum corrosion of wrought iron and steel. The contact of soft putrifying mud appears to be still more destructive. Steel generally corrodes more uniformly and slowly than wrought iron. Hardened

[2] These tables are not susceptible of abstract, but they are being prepared for publication in the forthcoming volume of the Transactions of the Institution of Civil Engineers.

[3] The author thus describes the mode of analysis practised by him:— "The method adopted by me, in most cases, was a modification of Regnault's process, which consisted in mixing the cast iron, finely pulverized, with about twelve times its weight of chromate of lead properly prepared, and mixed with a little chlorate of potash. This is burnt in an ordinary combustion tube, in the remote extremity of which some dry powdered chlorate of potash is placed, and heated after the combustion has been completed, so as to pass a current of oxygen over the ignited mass. This precaution is indispensable with the harder and denser irons, containing most of their carbon in combination. The total amount of constituent carbon is thus obtained, and weighed as carbonic acid: but this consists of graphite and of combined carbon. By a separate assay, the graphite is obtained, on solution of a weighed portion of the metal in nitric acid, as residue, consisting of graphite, extractive matter (from the carbon of combination) and silica, and occasionally some oxydes of combined metals. The residue is filtered and washed, boiled in caustic potash, by which the silex and extraction are taken up. The graphite remains: it is again washed with dilute muriatic acid, then with water, and weighed after drying. The difference between this and the total amount of carbon given by the combustion is equal to the carbon of combination.

"For the other constituents, after a preliminary qualitative trial, about 120 grains of the cast iron were dissolved in nitric acid, evaporated to dryness with a strong heat, and ignited in a platina crucible with three and a-half times its weight of carbonate of soda. After cooling, water is poured over it, which carries off the excess of alkali and an alkaline phosphate or sulphate, if the iron contained sulphur, which should be ascertained beforehand, leaving the peroxide of iron to be separated by filtration. The filtered liquor must now be boiled for some time to destroy the manganesiate of potash in solution, and precipitate the manganese; again filtered, nitric acid added, evaporated to dryness, and silicic acid separated, if any exist, on heating with water, after moistening with acid in the usual way. Ammonia is now cautiously added, and if the iron contained aluminum, a basic phosphate of alumina precipitates. The solution, again filtered, is acidulated with acetic, and the phosphoric acid precipitated by acetate of lead. From the phosphate the phosphoric acid cannot be estimated with certainty; it was therefore converted into sulphate of lead, and the phosphoric acid got from its weight.

"The silex and manganese were always obtained by precipitation from the iron, &c., in separate assays; the method with benzoate, or succinate of ammonia, though inconvenient, is one of the best where the amount of iron is considerable. Leibig's process of separation, by boiling with carbonate of barytes, succeeds very well, and presents no difficulties; but when the amount of manganese is so very small in proportion to the iron, I preferred the former mode. The iron itself, from its inconvenient bulk, was generally estimated from the other constituents. Separate assays are also best made for sulphur or earthy bases; but as far as my observation goes, these are extremely rare in British cast-iron.

cast steel, after "tilting," has the average minimum corrosion, and low shear steel, which is in fact a sort of steely iron, has the maximum.

The author has made researches on the nature of the peculiar carbonaceous substance which he has called "plumbago," formed by the decomposition of cast iron in sea water, and in other conditions, and also occasionally from wrought iron and steel, and on the other organic products of such decompositions. His reasonings tend to show, that this plumbago in part results from the decomposition of carbonic acid in solution in the water, and is therefore highly interesting to the chemist, as an instance of crystallized carbon being so formed. The rust produced by the prolonged action of air and water on iron, is brown hæmatite; and omitting all minute or accidental constituents of the iron, its formula is $2\ Fe^2 O^3 + 3\ HO$, more or less mixed with spathic iron ore $= Fe\ O \times CO^2$. When very old, these lose water, and become "fer oligiste," or anhydrous peroxide. The author then discusses the conditions most and least favourable to corrosion in marine steam-boilers, with reference to the degree of saline concentration, boiling temperature, &c., of the sea water; and gives tables of the saline contents at various stages of concentration. Sea water, to act least on boilers, shonld be heated to 190° Fahrenheit, and be deprived of air before entering as feed water, and the less concentration takes place, the less will be the amount of corrosion. The tables of the amounts of corrosion of cast iron, in contact with definite alloys of copper with tin and zinc, are now extended to wrought iron. The corrosion of this is accelerated by the contact of either brass or gunmetal in sea water, but more so by the latter than by copper. He confirms his previous results that, except in atmospheric air, a coating of zinc, or contact of zinc in a massive form, affords to cast or wrought iron only partial protection from corrosion.

In foul sea water, the zincing is converted into artificial blende $= (Zn + Fe + S)$. Elkington and Ruolz's zincing process he finds capable of many useful applications for iron exposed to air, but he questions its efficacy in water, or where there is abrasion. Zink paint he states to have been found the most durable of all the paints and varnishes tried, except coal-tar laid on hot, and the asphaltic varnishes. The author then enters largely into many questions relative to the corrosion and fouling of iron ships, applying to them the laws he had previously deduced. Based on the known effects of a slightly alkaline solution in preventing corrosion, he proposes lime-water to replace bilge-water, and thus to prevent internal corrosion in iron ships. He describes his prolonged experiments on the means of preventing their external corrosion and fouling, and the details of his methods of preventing both. These consist in coating the plates with an alloy of zinc with mercury, and a very minute portion of the base of either of the alkalies. The coating is effected by peculiar methods to ensure perfect uniformity; and the principle of protection is, that the alloy produces by the first action of a menstruum, a surface of amalgamated zinc which is insoluble. This coating is protected by an asphaltic varnish, to prevent the contact of the slightly soluble poisonous paint, with which the ship's hull is payed over to prevent fouling. Several metallic salts are fitted to act as poisons to the molluscous and testaceous animals which infest ships' bottoms; but the author's experience leads him to prefer oxychloride of copper, which is, in fact, the salt formed on common copper sheathing, and which by its poisonous qualities keeps it clean.

The author's method has been in use for some time on vessels which have made voyages to the tropics, and its usefulness in preventing fouling, &c., has been fully proved. He discusses and explains the errors which have been made as to the non-corrosion of ships kept in motion, and shows that corrosion does take place, but that it is not so perceptible as when the ship remains at rest. He shows that magnetism has nothing whatever to do with the amount of corrosion in iron vessels, and also discusses at length, various contingent circumstances promoting partial corrosion in iron ships: the nature of cargo, the mode of fastening the machinery, the contact of boilers, of various timbers, and of the same when decayed, &c.; all of which are of practical importance to the iron ship-builder or marine engineer. Kyanized timber is rapidly destructive of iron, in contact with it; in sea water it more than doubles the rate of its corrosion. After giving a table containing the numerical values, for iron ship-building, of a number of qualities of British wrought iron, the author proceeds to discuss in detail the principal methods of protection for iron, which have been recently promulgated by Berry, Neilson, Shore, Elkington and Roulz, Hall of Bermondsey, Crawford and Fountain-Moreau, all of which are patented; but none of them, except that of Elkington and Ruolz, are, he contends, proved to be of practical value in the conditions above mentioned.

Lastly, he states that as uniform corrosion cannot be ensured in the case of iron ships, and as local action is liable to produce fatal accidents at unlooked-for moments, protection from corrosion and fouling, must be considered essential to the safety of iron ships; if so protected, the author contends that they are safer in every respect than the best vessels constructed of timber. He also gives instances from various authorities of the rapidity with which foulness accumulates on ships' bottoms, even of wood, and more so if of iron, and dissents as to the possibility of removing the fouling of iron ships by any scraping process, unless performed in the dry dock, and constantly repeated.

The communication concludes with some observations, as to the presumed differences in the rate of corrosion, between railway bars in use and out of use, or traversed in one or in both directions. Upon this subject the author has experiments in progress on several railways, and expects at a future time to lay the results, as to the amounts of loss by corrosion and abrasion, before the Institution; at present his belief is that railway bars, being otherwise in the same condition, corrode alike, whether travelled over or not.

Remarks.—Dr. Ure said that the part of Mr. Mallet's paper which was most interesting to chemists, was the mode of analysis. This was always a subject of delicacy, difficulty, and labour. His own mode of analyzing cast-iron was somewhat analogous to that which had been described. He took a portion of iron, reduced by filing to a fine powder, mixed it with the same quantity of chlorate of potash, and five or six times its weight of clean siliceous sand, to dilute the mixture: this was heated in the usual way, in a combustion tube with more chlorate of potash, whereby all the carbon contained in the iron was converted into carbonic acid, which was passed through a solution of the sub-acetate of lead, instead of potash water. Carbonate of lead was thus produced, and its amount, when washed and dried, gave the quantity of carbon in the iron operated upon, 134 parts of carbonate of lead, indicating 6 parts of carbon; therefore $\frac{1}{100}$th of a grain of carbon might be detected by this method. The question as to the state in which the carbon existed in the iron was more difficult of solution. Karsten's mode of determining this point was very delicate and accurate: the pulverized iron was mixed with moistened chloride of silver, which acted upon the metallic iron alone, leaving the carburet of iron untouched, and its amount could thus be determined with great nicety. With white iron which could not be filed, the chloride of silver was formed into a mass. A disc of it being placed at the bottom of a vessel with a little water over it, the piece of iron was laid upon it; a few drops of muriatic acid were then added, and in eight or ten days the iron was dissolved, leaving untouched the carbon, which existed in the form of graphite.

Mr. Williams agreed in the advantage of preventing the corrosion of iron vessels, but he feared the expense of the mode proposed by Mr. Mallet, particularly as at present, although comparatively unprotected, they were very durable. He instanced particularly the light boats on the river Shannon, which, although constructed of very thin iron, and had been at work between six and seven years, exhibited no signs of decay.

Mr. Rendel said that the durability of iron canal boats was well known. On the Tavistock canal, there now existed some boats which had been employed for 25 years in carrying coals, iron, and copper ores, or other goods, and yet they were not extensively corroded.

Mr. Field stated, that although in India iron generally corroded rapidly, the iron vessels that had been sent there, did not appear to be affected sooner than in England. He had been informed by Mr. Laird, that the boilers of the *Garry Owen* iron steamer, had been renewed twice in nine years, and on every occasion it had been remarked, that although the bottoms of the boilers were entirely destroyed, the iron plates of the hull of the vessel immediately beneath them retained their original coat of paint, and were not at all corroded.

Mr. Jordan suggested the probability of the hull of the vessel being protected at the expense of the boilers, on account of the electric character of the metal being altered by the heat of the boiler, and the general circumstances induced.

Mr. Field said that the boilers in question had lasted as long as they would have done on board a timber-built vessel.

Mr. Williams corroborated the statement. The boilers had worn out in the regular time, and had failed first in the usual spot, which was the bent plate, where the sides joined the bottom. There was not any thing remarkable in the wear of the boilers.

Dr. Ure thought that the heat of the boilers having probably been sufficient to dry up any moisture from beneath them, might have tended to preserve the hull of the vessel from corrosion in that spot. It was easy to account for a less degree of corrosion taking place in iron ships, or on rails of railways, as long as the former were constantly kept moving, and the latter were regularly travelled over. In these cases any oxydation which took place was rubbed off as it was formed; but if either were in a state of inactivity, the scale of rust permitted an accumulation of moisture beneath it, an active galvanic pile was completed, and oxydation went on with increased rapidity.

Mr. Vignoles remarked that the paper did not notice the iron water-tight bulk-heads for vessels, which had been introduced by Mr. C. W. Williams. Their practical utility was now generally admitted, and he believed they were about to be adopted in the navy.

Mr. Williams said that about nine years since, he first introduced the system of dividing the hull into five compartments, by four water-tight iron bulk-heads, with the intention of their adding to the strength of wooden vessels; but it occurred to him that they would be otherwise useful, and although the ship builders opposed it, he persevered, and now all the vessels under his superintendence had them. Their value had been proved on many occasions, and by them, the *Royal William* and several other vessels had been saved. With four bulk-heads it was impossible for a vessel to sink, unless three of the compartments were broken into, which was scarcely possible.

The President believed that the *James Watt*, which was built at least 16 years since, had three close timber bulk-heads, intended for the same purpose as the iron ones.

Mr. Williams replied that they would not answer the same purpose as the iron ones, and that if a vessel had only three bulk-heads, making four compartments, if one of them was broken into, the vessel would sink, but with five compartments it would be saved. With regard to the general durability of iron vessels, he recollected an iron vessel being built at the Horseley ironworks more than 20 years since, which he believed was still in existence; and a small boat, built for him by Mr. Grantham, of very thin plates in the year 1824, was still at work.

The Secretary stated that the vessel alluded to by Mr. Williams, was the *Aaron Manby*, which was built by, and named after his father in the year 1821. It was the first iron vessel that ever went to sea; it had been very roughly used, and the engines and boilers had been more than once renewed; yet the hull had scarcely required any repairs, and it was very slightly corroded, although it had been severely tried by being used in both fresh and salt water upon the river Seine, for which service it was built.[4] It was well known in Staffordshire, that many iron canal boats which were used indiscriminately for carrying coals, iron ore, limestone and other cargoes, and had received scarcely ordinary attention, were upwards of 40 years old, and were still serviceable.[5]

Mr. Braithwaite said that he had recently heard of the sale of a wooden vessel 45 years old, which was still sea-worthy, and was capable of being insured.

The President observed, that although part of two evenings had been devoted to Mr. Mallet's paper, yet that such was its value, that it could scarcely be discussed until members could pursue it at leisure, and enter into the wide field of observation which it embraced: it was a paper of undoubted merit, and the attention of the Publication Committee had been directed to it by the Council, in order to its general circulation, with the former valuable paper, by the same author, as soon as was practicable.

Electro-Magnetic Telegraphs.

A pair of electro-magnetic signal telegraphs, constructed for the Aix-la-Chapelle railway, from the plans of Professor Wheatstone, were exhibited.

Professor Wheatstone explained, that the principle of this signal telegraph, which he considered to be the most efficient arrangement for practical purposes, was the same as his last electro-magnetic telegraph, in which a dial, or hand, was caused to advance by the alternate attractions and cessations of attraction of an electro-magnet, occasioned by corresponding alternate completions and interruptions of the circuit, by means of a peculiarly constructed apparatus, placed at the opposite end of the telegraphic line. The present signal telegraph was intended for the use of the inclined plane on the railway at Aix-la-Chapelle, where only a limited number of signals were required; the entire alphabet of the complete telegraph, was therefore dispensed with, and the instrument was restricted to six elementary signals. The letters M, S, C, T, B, &c., on the face of the dials were the initials of the German words for engine, rope, train, telegraph, &c. The dial was eight inches in diameter, and the characters were conspicuous, so that they might be readily seen at a distance; the hand, which was required to be made very light, and to keep its form, was of blackened mica. The cross being reserved to indicate the quiescent condition of the apparatus, there remained five available characters, which, combined two and two, gave 25 signals—a number amply sufficient for the purposes of the railway. It being established as an invariable rule, that each signal should consist of two characters followed by the cross; were the telegraph to act in any way irregularly, the index would, at the end, point to some other character, instead of the cross, and this would indicate that the preceding signals were wrong, so that if the signals received, should not correspond with those sent (which, however, could not be the case if ordinary care was taken), no mistake could possibly arise, because they carried with them the evidence of their error. The instruments were furnished with a simple means of bringing the hand immediately to the resting point, without interfering with the circuit. As it might be occasionally required to transmit a permanent signal, which should remain, until a person arrived to inspect it, the five simple characters could be employed for this purpose.

The instruments at each station consisted of a telegraph, an alarm, and a communicator; they would be arranged in the circuit, in several ways to suit particular purposes, but no other alteration was requisite to effect this, than a change in the disposition of the terminal wires, and of their connexions with the communicators. The telegraphs might be so placed, that they would act simultaneously, when either of the communicators was worked, or they might be so arranged that the instrument at one station, should only be acted upon by the communication at the other, which, in many cases, was preferable, as a great resistance was thereby taken out of the circuit. Other arrangements, useful under particular circumstances, were also practicable. This telegraph, even when all the letters of the alphabet were employed, required only a single circuit of communications between the two stations. Professor Wheatstone's former permutating magnetic needle telegraph, though possessing a power of combination far exceeding that of any preceding telegraph, in which magnetic needles were proposed to be employed, required a number of wires proportionate to the number of signals.

By employing the earth, or an extent of water, to return the current, or complete the circuit—which might be done, by connecting the two extremities of one of the communicating wires with plates of metal, and plunging them into the earth or into water—one of the communicating wires might be entirely dispensed with; this plán would be adopted at Aix-la-Chapelle. That a large extent of earth, or a portion of a river, could be made to complete an electric circuit, was long since established with respect to electricity of high tension, by the extensive experiments of Dr. Watson, in 1748, and others; and the same thing was proved with regard to voltaic electricity, by the independent experiments of Erman, Basse, and Aldini, made in 1803. Erman's experiments were performed in the river Havel, near Potsdam; those of Basse in the river Weser, and the environs of Hamel; and Aldini's researches were prosecuted on the shore near Calais. Professor Steinheil also employed the earth as a means of completing the circuit, in the electro-magnetic telegraph which he established at Munich in 1838.

A pair of Professor Wheatstone's telegraphs were established at Berlin in the beginning of 1842: the line of communication was a single wire, carried through the air upon wooden posts, and plates of metal attached to the ends of the wire were buried in the ground. In the same year he formed a communication between King's College and the shot tower on the opposite side of the river: the communicating wire was laid along the parapets of Somerset-house and Waterloo-bridge, and thence to the top of the tower, where one of the telegraphs was placed; the wire then descended, and a plate of zinc attached to its extremity was plunged into the mud of the river; a similar plate was attached to the extremity at the north side, and was immersed in the water. The circuit was thus completed by the entire breadth of the Thames, and the telegraphs acted as well as if the circuit was entirely metallic. The peculiar construction of the present signal telegraph, enabled a magneto-electric machine to be substituted for a voltaic battery. This source of electric action not being subject to cessation or diminution, the attention necessary for keeping a voltaic battery in order, was dispensed with, and the instruments were always ready for action, without any previous preparation.

ON FRESCO PAINTING.

Abridgment of Mr. Charles H. Wilson's Report to the Commissioners of the Fine Arts.[1]

Mr. Wilson in this report first describes and considers the construction of the walls on which frescos and other mural paintings are executed, and then proceeds in order with the other portions of his subject.

Mural paintings were executed upon plaster of various kinds, laid upon walls variously constructed; several examples also occur of frescos which were painted upon plaster laid on lathing. The comparative durability of works executed under these circumstances Mr. Wilson explains by several examples, on the Continent. They are found on three kinds of wall:—ashlar walls of Gothic edifices—brick walls of buildings of different dates—and upon coarsely built rubble walls of different kinds. To these are to be added frescos on lath, of which there are many examples in different parts of Italy. From the observations which have been made by Mr. Wilson, it appears that plaster will not stand well upon ashlar walls, unless the stones be small and the seams open; for if the plaster be loosened from this kind of wall by damp or accident, it entirely falls away in large masses, showing that it does not adhere firmly to the masonry. Brick walls are the best for fresco, and the practice of the careful Germans and modern Italians are in favour of this opinion.

There are many specimens of frescos *upon lath* in Italy; the most ancient is that of the "Trionfo della Morte," by Orgagna, in the Campo Santo of Pisa. The artist probably adopted the precaution from having entertained

[4] "Iron as a Material for Ship-building," by J. Grantham, 8vo., London, 1842, p. 6.

[5] In a letter from Mr. John Laird, dated June 29, 1843, he says, respecting the probability of corrosion in iron vessels, "I beg to state that the following vessels have had their boilers replaced (some of them twice), and that the bottom and sides of the vessels near the boilers have been found quite free from corrosion; in fact, the paint originally put on was almost perfect:—

Lady Lansdowne, built in	1833
Garry Owen	1834
Eliza Price	1836
Duncannon	1836
Duchess of Lancaster	1839

"The *Euphrates* steamer, built in 1834, has had her machinery taken out, and been converted into an accommodation boat for passengers for the Indus. The hull of the vessel was found quite perfect, free from corrosion, and as perfect and sound as the day she was launched."—Sec. Inst. C. E.

[1] C. H. Wilson, Esq., Director of the Government School of Design at Somerset House, was, in the course of the last year, employed by Her Majesty's Commissioners on the Fine Arts to proceed to the Continent to collect information relating to the objects of the Commission. Having been furnished with the necessary instructions he left England in August and returned in January last.

doubts as to the fitness of the walls of this edifice to receive frescos. The ceiling frescos in the upper Loggia of the Vatican by Giovanni da Udine are upon stoja or lath: the wooden framing to which the lath is attached is executed with a rudeness that would seem almost incredible, and these works have suffered severely from the original defective carpentry and from neglect and damp. (See Figs. 1 & 2.)

Fig. 1.

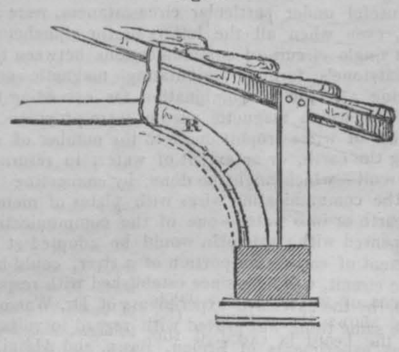
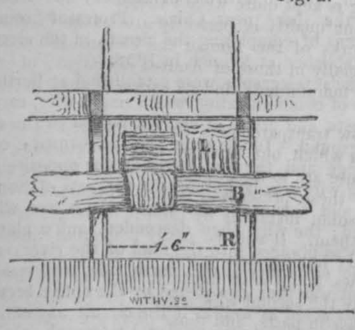


Fig. 2.



From various instances quoted in the Report it appears that frescos may safely be executed upon lath.

The Mortar.—It is not possible to make many observations on the mortar on which mural pictures of the period before referred to are executed, as, fortunately, there are not a great number which are in such a state of dilapidation as to permit a particular examination of them in this respect. The majority of these pictures are painted, as is well known, upon an intonaco composed of lime and sand. It is evident that there was a diversity of opinion with regard to the quantity of sand to lime to be used, and the same diversity of opinion exists amongst the modern *frescanti.* From such examination as it was possible to make, it appears certain that those frescos have stood best in which it is apparent that there is a considerable proportion of sand in the lime; and I am disposed partly to attribute the bad state of the frescos by Correggio in the Duomo of Parma to his having used what is called a rich intonaco (that is, with a small proportion of sand), and the faintness of the colours is perhaps to be attributed to the same cause.

A number of mural paintings are executed upon an intonaco formed of lime and marble dust; these however are not frescos but distemper pictures; that is, pictures which, although in many instances commenced in fresco, yet were finished in distemper. Pictures of this description are also found upon intonacos of lime and sand; and if at first the practice may have arisen from necessity, it appears to have been continued afterwards from choice, even after complete works in pure fresco had been executed.

There is nothing to be learnt apparently from old Italian plastering. In point of execution, it is surprising that such careless work could ever satisfy the artists. The Venetians have shown themselves in many instances clumsy plasterers beyond all others; the works of Pordenone especially exhibit the rudest workmanship, the surface being very uneven, and the joinings of the intonaco which mark the different day's work being very carelessly executed: such is also the case in the frescos of Titian. The Florentine practice is better, but still far from presenting, in many of the early examples, sufficient attention to the preparation of the surface. If the wall was even, the plaster was made even, but if the wall was altogether the reverse, the plaster was allowed to be so also, and it is only in the works of later masters that we find this workmanship so attended to as to secure an even surface: the frescos of Allori in S. Lorenzo and in the Palazzo Vecchio are models in this respect.

In the Baths of Titus examples will be found of—first lime and coarse sand, half an inch thick; then lime and pozzolana, of one inch in thickness, in which, however, there is an admixture of sand and pounded brick; the last and upper coat is of lime and pounded marble. It will be found that this, as regards the two last coats, is the identical preparation which is so commonly used in Italy for floors under the name of Venetian pavement, except that in the latter the fragments of brick in the substratum and the fragments of marble in the superstratum are much larger. It is also quite plain, from the size of the fragments of marble in the specimens of ancient plaster, both in the Baths of Titus and at Pompeii, that the wall could not possibly be brought to a smooth surface either with the trowel or float; it must have been allowed to dry, and was then polished. It follows that in walls of this description the red, yellow, and other tints with which it was painted must have been subsequently applied, and had nothing of the nature of fresco, an art which, however, is apparently exemplified in ancient examples, for instance, in the Nozze Aldobrandini.

It may be generally stated, without adducing other examples of this period, that where the plastering is uneven, the ruin of the fresco, or its serious injury, is the result, whilst those frescos which have smooth and even surfaces will be found to be generally in good condition; and the most perfect specimens in point of workmanship and preservation are the frescos of the Caracci and of their scholars. These, in the majority of instances, are quite perfect, and may be quoted as triumphant specimens of the durability of this mode of painting.

The Execution of the Picture.—We find that whilst several mechanical modes of outlining (first Report) were adopted for fresco, each artist used these means in his own peculiar way, little influenced apparently by any received rule; and as every artist commonly adheres to his own method, the execution of the outline may assist in deciding on the authorship of a work of art.

The practice of *indenting the plaster* with a point or stylus is very ancient, and we find that the figures painted in Etruscan tombs were thus outlined, that is, the point was used to mark the external outline of the figure only. It was employed by the early masters at the revival of art in Italy precisely in the same way in outlining their works in distemper on panel; thus Giotto drew, and his followers; and we find the same practice follow in the Sienese school, with a singular exception, which is, that the figure of the Madonna is entirely marked in with the stylus, that is, not merely the external outline, but the outlines of folds in the drapery are drawn in in the same manner; and a notice of this practice, confined to the school of Siena, is useful, as it establishes a clear distinction between the early pictures of that school and those of the contemporary Florentine masters. It has been supposed by some that these outlines were intended as a guide to the plasterer in spreading the intonaco, but in no case do the joinings in the plaster coincide with them. If we suppose that the composition was thus sketched in to enable the artist to judge of the proper proportions and positions of the figures, what then was the use of his cartoon in this respect? it would have been more easy to place it against the wall, as is now frequently done.

Another mode of outlining, that is by *pouncing,* was extensively adopted; this method, as well as the last-mentioned, of course implies the preparation of a large cartoon; and there was still another mode, or rather union of the modes above alluded to, viz. the outline was first pounced and then, the cartoon being removed, the forms were retraced with the stylus; this is the practice of the modern Italians, and although imposing names may be quoted in support of it, an uncertain and feeble outline is the result, and besides, in sudden turns it breaks out bits of the plaster, leaving unsightly holes in the picture.

Painting.—In studying the art of fresco-painting, it is necessary to consult the works of the old masters for examples of execution. In everything that is merely mechanical, we may profitably study the proceedings of the modern Germans; every process may be learnt from their practice, without visiting Italy, the graceful use of the brush excepted. Amongst the works of the present Italian fresco-painters, there is perhaps no example which it would be desirable to follow. The execution of these artists is to the last degree mannered and heavy, and however satisfactory may have been the progress of the French in other modes of painting, they have entirely failed in the few attempts which they have made in fresco.

Avoiding the errors into which we may conceive that our continental brethren have fallen in the actual painting of their frescos, we must look to the works of the old masters as examples; in these we shall find painting in fresco, in as many styles, and exhibiting as much diversity of touch and handling, as may be observed in the works of the same artists in oil. There is the same liberty of thought in the treatment of both methods, and genius exhibits its powers with as endless a diversity in the one art as in the other.

We find in the frescos of the old masters every quality of execution that has a name in oil-painting, although those qualities are necessarily exemplified in different degrees; we have transparency, opacity, richness; we have thin and thick painting, nay loading, and that to an extent that cannot be contemplated in oil. We have the calm transparent elegant painting of the Florentines and Romans, the rich variety of the Venetians, and there are cases in which the well-nourished brush of Rembrandt seems represented in the works of the fresco-painters of old Italian times.

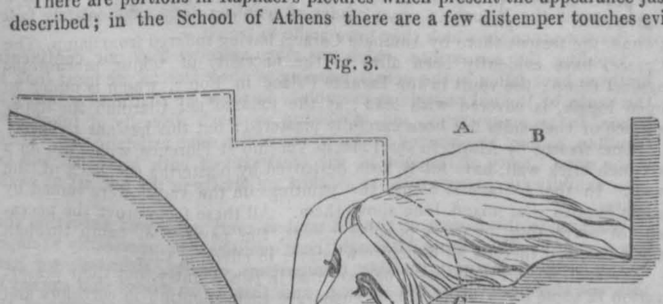
The distemper paintings of the elder masters have already been alluded to; it was their practice in laying in the preparatory tints in fresco, to make some of these totally different from the colour to be used in finishing in distemper: thus, a dark red colour was almost invariably laid in as a preparation for blue, and this practice was generally adhered to with very few exceptions till after the time of Raphael. In the works of Giotto, in the Campo Santo, at Pisa, the plaster seems to have been painted black in the first instance. Time did not permit a satisfactory examination of these works, but there is an example of the use of black as a preparation for blue in the Farnesina, where Daniele da Volterra in his frescos on a ceiling in that edifice has first laid in a coat of black in fresco, and then a coat of blue in distemper. In some pictures, as for instance in those by Andrea Mantegna in the Eremitani at Padue, the blue of the skies has either partially changed or entirely faded, whilst that of the draperies is comparatively well preserved, it is thus evident that from motives of economy different blues were used in different portions of pictures. There are many other examples of this in other parts of Italy.

The Cardinal Bonaventura, in the fresco called the Dispute of the Sacrament, by Raphael, is represented in a purplish-black robe which has been painted over red; this is an instance of the adoption of an indirect process with reference to another colour besides blue. It may be observed, that the cardinal was a Franciscan, an order which is distinguished by a brown dress; and, as it is not brown in the picture, this may perhaps be an instance of a change of colour: but one object of this mode of painting seems to have been the security of the colours against change, while another may have been, the attainment of more harmony in the tone. In the picture just mentioned, Raphael has followed precept in painting the blues in distemper over red, and these have stood perfectly. In the School of Athens, on the contrary, he has painted in the blues in fresco, and they have perished or nearly so, as they have been in most instances in every part of Italy where blue has been thus used; both in pictures of this and of previous times. In the great works which Raphael subsequently painted in the Stanze he returned to the old practice of painting the blues above red, probably dissatisfied with the crudeness which was the result of using them on the wet plaster. The blue that has thus been generally used seems to have been of a vegetable nature, as in many instances it has changed to a brilliant green. It may be urged that the use of ultramarine or cobalt may obviate all necessity for such preparations, and secure the pictures against change; but whilst the former is by far too expensive a colour, the latter is crude and harsh in fresco. It seems to have been the blue which was used by the Caracci, and in their pictures, as in those of Guido, it will be found to be frequently out of harmony with the other colours; either these have in some degree faded, the blue remaining the same, or the blue has increased in intensity. Domenichino used distemper extensively in his works; but in those of Guercino will be found a triumphant solution of the difficulty; his blues are put in in fresco, and yet are in fine harmony with the other tones, they have generally a warm purple hue, and may be either smalt, or cobalt tempered with red, such as colcothar of vitriol. This is strongly exemplified in the Zampieri Palace at Bologna, where the harmony apparent in a fresco of Guercino is an agreeable relief, after the crudity which offends in those of his masters in other rooms of the same palace: a comparison between the Aurora of Guido in the Rospigliosi at Rome (all the blues in which are not retouched) and that by Guercino in the Ludovisi, further corroborates the above observations.

As has frequently been stated in the previous report, it was the practice to retouch when the fresco was dry, more especially in the shadows. In some cases it is now easy to detect this retouching: it will generally be found to be proportionably somewhat darker than the painting around; and whilst in many frescos a remarkable polish or gloss may be observed even in situations where that effect could not be produced by rubbing, the retouched parts are invariably dim; this is exemplified in the Evangelists by Domenichino in the church of S. Andrea della Valle at Rome: these are historically known to have been retouched; and in viewing them from particular spots, their surfaces are seen to shine as if varnished, whilst some parts, which it may reasonably be inferred are retouches, such as darks under the arms and in the deep folds of the drapery, are quite flat and dim.

There are portions in Raphael's pictures which present the appearance jus-described; in the School of Athens there are a few distemper touches evi

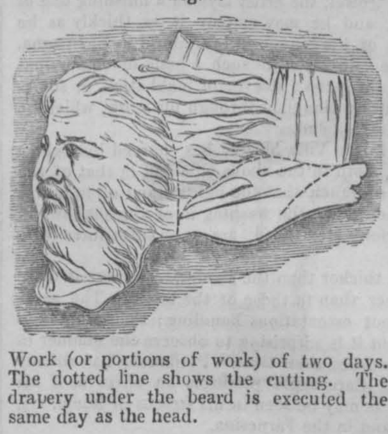
Fig. 3.



A, The entire space above the dotted line is painted in one day, and the flowing hair included; the cut being made at the dotted line C. The line B B, represents the joining that less careful artists would have made. C C C, Boundary of another day's work.

dently by the master's own hand, which have darkened: for instance, in one head he has had recourse to distemper to represent the external locks of hair. This seems to indicate a difficulty in fresco which at first sight appears formidable. In a picture by Gaudenzio Ferrari, at Milan, a female head with long flowing locks is represented, and the joining is made next the locks, and has a very bad effect; the difficulty is successfully overcome by the German artists without having recourse to distemper, and without placing the joining so as to injure the appearance of the picture. This may best be exemplified by a sketch: the flying tresses are painted in on the back-ground on one day, and the head is put in the next day; the joining is indicated by the dotted line in the figure (Figs. 3 & 4). The foliage of trees is managed in the same way. It would be vain to think of cutting round the outline of foliage; the outer leaves and thin projecting branches are executed on the same day with the back-ground, and the cutting is kept quite within these.

Fig. 4.



Work (or portions of work) of two days. The dotted line shows the cutting. The drapery under the beard is executed the same day as the head.

Transparency.—This important quality is perfectly attainable in fresco-painting; it is found in the works of the Roman and Florentine masters; amongst the latter, more especially in those of Andrea del Sarto; in those of the Lombards it is admirably maintained; and its excess is seen in those of the Venetians.

It is not easy to explain how transparency is to be attained in fresco; there is, perhaps, no quality in which our German brethren are more deficient; the brushes which they use are to an English eye small for the work, and the first tint laid on with these presents a streaky appearance, which perhaps could be obviated in some instances by the use of larger brushes, and a different mode of using them. It will be easily understood how this streaky appearance is produced; having first given one wipe of the brush full of colour, the artist follows it up with another, the colour sinking in instantly, and as he cannot lay the second wipe exactly to the edge of the first, the one overlaps the other in parts, and those parts are consequently twice as dark as the others which have got only one wipe, and so he proceeds laying a tint composed of light and dark streaks, but nevertheless transparent: this quality is lost in uniting the tint, for he continues to go over the surface till he obtains what he seeks, a quiet flat tone, which however generally proves a heavy one. Now, in the ancient examples, this union is obtained without sacrificing transparency. In a church near Conegliano there are some curious frescos by a Venetian painter, in which the excess of this quality is exhibited; they do not merit the name of works of art, and are very slightly executed; the colours seem laid in in one wash only, the plaster ground shining through; but these bad pictures prove that it is possible to lay in tints in a transparent and yet flat manner.

Titian frequently makes use of the bare intonaco in particular places; thus in his fresco of The Healing of the Foot of the Boy &c., in the Capitolo of St. Antonio at Padua, the shadows are laid in with brown in a very transparent manner, and for the half-tint he has left the bare lime. It may be doubted whether this practice is to be recommended; it is never found in the frescos of the Florentines or Romans, and that great fresco-painter, Luini, obtains equal lightness and transparency without having recourse to it. Such a practice gives a work a sketchy character which is objectionable, especially in the principal figures.

How the effect of transparency is to be mechanically obtained it remains for the artist to discover by practice.

A Milanese professor says that with a view to transparency it is necessary to lay in the first tints early in the morning, and then to leave the work and not resume it for two hours. He further says that the lime, if it have any remains of an injurious caustic quality, exhaust its fury, to use his own words, on these first colours, and may be more safely painted on afterwards. It must be confessed that the frescos by Appiani, which he instanced as examples of the practice, are very far from exhibiting the quality of transparency. Other artists, however, hold the same opinion, and it is therefore proper to state it.

Hatching.—The prevalence of this practice amongst many of the old masters (for it is evidently not always the result of retouching) seems to prove that they also found a difficulty in getting flat tints; in some of the later masters it is a mere manner, but in earlier and better examples it may have been adopted in the hope of getting a flat tint without destroying transparency: whatever was the reason the practice was very general, and it is to be observed that the great masters did not cross in this hatching; the lines lie all in one way, and Signor Colombo of Rome, says that the tempera hatchings in Michael Angelo's Last Judgment are thus laid on with great evenness and dexterity.

In the works of Raphael, the most perfect of fresco-painters, there is no hatching anywhere, nor is there in those of Correggio. The hatching with which the Cupids of the last named painter in the Convent of St. Paolo, at Parma, are covered and destroyed, is manifestly the work of another hand; the lunettes underneath have fortunately escaped this profanation.

Solid Painting.—This is a quality that is easily attainable; it will be best understood by observing, that whilst the plasterer lays on a preparatory intonaco of lime and sand with the trowel, the artist lays on a finishing one of lime and colour with the brush, and he may employ it as thickly as he pleases. I observed in the works of Pordenone in Sta. Maria in Campagna, at Piacenza, that the lights were laid on with such a body of colour that before the lime had time to set, the artist's sleeve, or mahl-stick, or something else in his way, has accidentally ploughed through his work, which he has not been able, or has not cared to mend.

Paul Veronese, in his frescos in the Villa Mazer, has charged his lights; and his imitators in their works, both in the above villa and in that of the Obizzi near Padua, have loaded so much that the lights stand up in lumps upon the wall. Such extravagancies, like the washing in of the shadows in the pictures near Conegliano before mentioned, are poor substitutes for a careful imitation of nature.

The lights must of necessity be thicker than the shadows, as there is more lime in the colours of the former than in those of the latter. The great masters laid in their colours without ostentatious handling; their works exhibit no tricks of manipulation; but it is surprising to observe the manner in which some artists seem to have worked their tints. Pordenone has already been alluded to, and Polidora da Caravaggio produces an effect as if his brush had been full of macguilp, as may be seen in his frescos in Rome, viz. in St. Andrea on Monte Cavallo, and in the Farnesina.

It is necessary to mention these instances to prove the extraordinary dexterity that has been attained in painting in fresco, a dexterity however, which is not to be admired when it produces such effects, and which too often distinguishes the pencil of mediocrity.

Glazing.—This process is frequently exemplified in the fresco-works of the old masters; its most successful application is seen in those of Razzi at Siena, where the celebrated picture called the "Cristo alla Colonna," in the gallery of the Academy, is a particularly interesting example of its legitimate application in fresco, that is, of its use while the plaster is still moist; in this instance parts are made out by means of it, and much lightness and transparency are attained.

Pordenone invented or adopted some process which resembles that common in oil-painting; his works have evidently been glazed after the lime had been allowed to dry; the flesh in all his figures is richly glazed—the transparent colour filling up the hollows arising from the peculiar loading already described as so remarkably exhibited in his frescos, if they can be called such. Polidoro da Caravaggio seems to have adopted some analogous method, but probably these are the only masters who can be quoted a having adopted a practice so foreign to fresco-painting. Perhaps the artist who lpainted the papal chair-bearers in the Heliodorus may be added to this brief list. The adoption of such a practice evidently arises from a misapprehension of the legitimate application of fresco-painting. It will be found that the Venetian painters generally had no clear idea of the true mode of employing this art: even Titian fell into the mistake of trying to produce effects of light and shadow and colours, like those which he had been in the habit of producing in his oil-pictures. The light and brilliant colouring of Paul Veronese enabled him to paint with more success in fresco than the generality of his Venetian brethren; but in his works it is evident that this is merely the result of his system, not any attempt at an application of the principles of colour suited to the peculiar art of fresco-painting, which he sometimes practised, and most successfully at the Villa Mazer. Palma Vecchio alone of the Venetian masters seems to have truly estimated the powers of fresco; there are two saints by him in S. Liberale at Castelfranco, which have breadth and dignity.

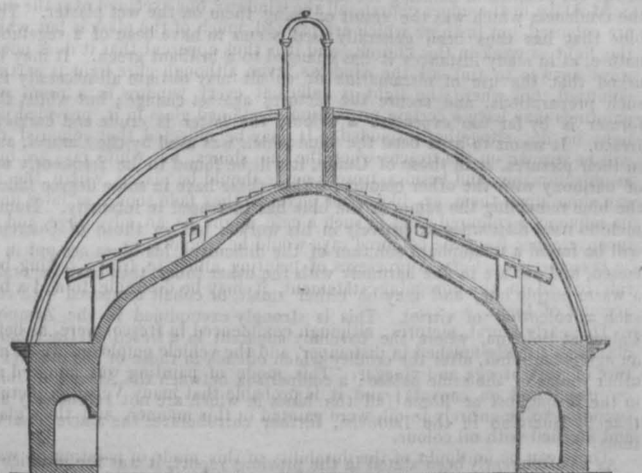
Razzi has already been alluded to as an artist whose works most prominently exemplify legitimate glazing in fresco; it is not apparent in the works of any other master to the same extent.

Time occupied in Painting.—It is not difficult, in examining some frescos, to ascertain the time occupied in painting them. In some examples, the joinings by means of which this calculation can be made are distinctly visible; in others they are either so well executed, or are so concealed by the use of distemper, that it is very difficult to trace them. It is evident that the old masters painted with great rapidity; large and important works, judging from the following examples, were executed in a month or six weeks.

The "Incendio del Borgo," in the Stanze, seems to have been painted in about forty days; the group of the young man carrying his father has been executed in three days. The exquisite group of the Graces, in the Farnesina, by Raphael, has been painted, at most, in five days. The Cupid and the head of the Grace, with her back to the spectator, have occupied one day; the back and part of the lower limb of the latter figure, another. In this day's work the rest of the leg may have been included. There appears to be a joining across the knee; there was certainly one across the next; both these joinings do not follow outlines, but are in parts of the figure which are in shadow. It is of course better, as has been already observed, to cut by outlines; but this is not always possible, especially in very large figures. The Germans prefer cutting across a broad light when circumstances compel the artist to make a joining where there is no outline. The graceful composition called the Galatea, also in the Farnesina, has been entirely executed in eleven or twelve days; the head and body of the principal figure have been painted in one day. This subject will be further incidentally illustr

Duration of Frescos.—The circumstances which must be taken into consideration in judging of the duration of frescos have already been adverted to. It has been shown that where proper constructive principles have been attended to, and where the walls are of good and appropriate materials, the safety of the paintings is in a great measure secured, and it may be certainly proved that fresco is a very durable mode of painting, not surpassed in this respect by any other, if indeed equalled. But independently of the most careful building, various causes may contribute to the deterioration or destruction of frescos, and as these have been very distinctly described in the First Report it is not necessary to say much on the subject further than to state a few facts. Damp is the greatest enemy of this kind of painting; it ascends through the walls from the soil, and descends from ill-constructed or dilapidated roofs. In Venice, where the houses actually stand in the water, the external plastering falls off entirely to a height of twenty feet; in Milan, Padua and elsewhere, I observed that paintings are obliterated on walls to a height of from seven to eight feet from the ground. The destruction of many fine works on roofs and on the upper part of walls is entirely to be attributed to culpable negligence, or to ignorance; this is painfully exemplified in the Duomo at Parma; the old insufficient roof over the dome still exists under the new leaded one which has been added to save the wrecks of Correggio's works from final destruction; and the inadequate construction of the former is sufficiently apparent in the section, Fig. 5.

Fig. 5.



Duomo, Parma.

Many examples might be adduced of injury resulting to frescos from imperfect roofing, and the fact having been recognized, precautions have now been taken after irreparable injury has been done. The tiled roofs of Italy have everywhere been a constant source of injury to frescos, but in some few instances precautions of an extraordinary nature have been taken to make the roof water-tight. At the Villa Mazer flat tiles have been laid at right angles to the roof-timbers, the joints being filled with lime. These tiles represent the planking under slates in this country, and the ordinary roof tiles are put over them in the usual way; this makes an impenetrable but very heavy roof. The plan has lately been adopted in the Palazzo del Giardino at Parma, the frescos there by Annibale Caracci having suffered from damp. The Caracci have evidently been alive to the necessity of taking precautions against damp: the vault in the Farnese Palace in Rome, which is under an open loggia, is covered with lead; at the Palazzo del Giardino the upper surface of the vaults has been carefully plastered; but this has not sufficed.

Some frescos by Allori, in the Palazzo Vecchio at Florence, which are on a six-inch brick wall, have lately been destroyed by plastering the back of the wall. In the Library at Siena, the paintings on the vaults were ruined by some masons who mixed lime above them. All these facts prove the necessity of preventing, by every possible means, the passage of damp through the walls, and there is no difficulty whatever in effecting this.

External frescos may never be executed in this country, but their preservation in some parts of Italy may encourage their adoption in corridors and porticos. Paintings are found to be well preserved on external walls turned to a favourable weather quarter. Thus, as at Genoa and Treviso, although frescos are nearly obliterated by the action of the weather on some walls, it is to be observed that wherever they are protected by the projection of a roof or cornice, they are well preserved. External damp or sea air has no bad effect. The obliteration of external frescos in Venice cannot be attributed to this, since those at Genoa are preserved; and those in the Campo Santo at Pisa, are doubtlessly destroyed by damp from the soil and roof. As has already been observed, that by Orgagna, in the same place, has not suffered at all from the action of the atmosphere.

The paintings in the upper loggia of the Vatican have suffered severely, owing to the inefficient construction of the roof. Those beneath, from Raphael's designs, have been much obliterated, partly by damp (the corridor above having been left open till lately), and partly from their having been painted on an intonaco of lime and marble dust; they have also suffered in some measure from violence and mischief.

Effect of Stained Glass on Paintings.—A few facts and observations connected with the employment of stained glass in rooms with paintings in them may not be unimportant, as an opinion has been expressed that windows coloured in any degree are incompatible with paintings in rooms so lighted. It rather appears, however, from many instances, that stained glass may be sometimes so employed with great advantage; and that the excess of light may be thus subdued or otherwise modified so as to produce the most pleasing effect.

In the cathedral at Munich the windows are coloured to a certain height, and although the effect is far from pleasing considered in itself, yet it is very useful as regards the pictures in the church, as the light is brought in from above in an advantageous manner.

At Saronno, near Milan, there are two small frescos by Luini with a coloured circular window between. The pictures are lighted by a window on one side, and could not be seen at all but for the exclusion of white light by the coloured glass in the centre window. In St. Patrizio, at Bologna there is an altar-piece under a window filled with richly stained glass; the picture is well lighted from an opposite window, but if the window over it had been of white glass it would have been impossible to see the picture, which is very dark. The sun happened to shine through the rich hues of the window above, and I observed here, as I had previously remarked at Saronno, that the picture did not suffer in consequence.

At Assisi in the upper church, all the windows, one excepted over the door, are coloured, but in those which are painted, much of the glass is left white; the light is weak in this church, and it is thus apparent that it does not always answer to tint all the windows, even although pure light is partially admitted, but where the light is sufficient every window in a room with paintings may have a certain proportion of stained glass in it, provided pure light be not altogether excluded. It may be objected that coloured rays will be thrown on the frescos when the sun shines, but white rays are quite as objectionable, and besides, frescos never should be placed where the sun can shine upon them, as, like other pictures, they fade sooner or later under its influence; coloured glass in such a case might be an advantage, and the inconvenience from the coloured rays would be temporary.

Fresco-secco.—Certain processes of painting allied to fresco having been referred to in the foregoing statement, it may be desirable to add a brief account of them.

The early mural pictures, although commenced in fresco, were, as before observed, usually finished in distemper, and the vehicle employed was a mixture of yolk of egg and vinegar. This mode of painting was adopted also on panel and on canvass; and it is probable that many Venetian pictures, supposed to be entirely in oil, were painted in this manner, and then glazed and finished with oil colour.

There can be no doubt of the durability of this mode of painting on walls, as there are many well-preserved examples of it by the early masters; but I am unable to quote any instance of the successful adoption of the process in modern times. Professor Overbeck informed me that he painted in this manner at Assisi, but that it was necessary to lay a ground of whiting on the wall in the first place—a process which is manifestly objectionable, and not in accordance with ancient practice.

An Italian artist informed me that it is necessary first to give the wall a coat of strong size, and then to give it a second coat mixed with the yolk of egg and vinegar.

Another mode of painting, of which there appear to be a few early examples, and of which there are many later ones, is called by the Italians *fresco-secco.* I was informed that a large painting by Orgagna, in the church of Sta. Maria Novella, is in fresco-secco. I examined it, but hesitate to pronounce an opinion.

The later masters painted extensive works in this manner: the ceiling of the great hall in the Barberini Palace in Rome appears to me to be in fresco-secco; and in Rome, Florence, and Genoa, the ceilings of most of the palaces are covered with paintings executed in this manner; it is the mode of painting still adopted in Italy for nearly all decorative purposes, is easy of execution, and unquestionably durable, whilst it is certainly the most economical process which can be followed.

Fresco-secco has been practised for some time in Munich: the ceilings of corridors of loggie and those of staircases, are thus painted in the palace; and the Chevalier Von Klenze, who first introduced the process at Munich, is satisfied with the experiments which have been there made with it.

The following is a description of the method. The plastering of the wall having been completed and lime and sand only having been used for the last coat, the whole is allowed to dry thoroughly. When a wall is intended to be painted, the surface of the lime is rubbed with pumice-stone, and on the evening of the day preceding that on which the painting is to be commenced the plaster is thoroughly washed with water, with which a little lime has been mixed. The wall is again wetted next morning, and then the cartoons are fastened up and the outline is pounced. The artist then begins to paint. The colours are the same as those used in fresco-buono, and are mixed with water in the same way, lime being used for the white.

If the wall should become too dry, a syringe, having many fine holes at the end, is used to wet it. Work done in this way will bear to be washed as well as real fresco, and is as durable: for ornament it is a better method than real fresco, as in the latter art it is quite impossible to make the joinings at outlines, owing to the complicated forms of ornaments; on this account walls thus decorated in real fresco present an unsatisfactory appearance. The joinings are particularly observable in the loggie of the Vatican.

Painting in fresco-secco can be quitted and resumed at any point. The artist need not rigidly calculate his day's work, and can always keep the plaster in a good state for working on. But whilst it offers these advantages, and is particularly useful where mere ornamental painting is alone contemplated, it is in every important respect an inferior art to real frerco. Paintings executed in this mode are ever heavy and opaque, whereas fresco is light and transparent. Fresco-secco has been chiefly adopted by late and inferior masters, and none of the works executed in this manner are of great reputation. The early pictures which are designated by the Italians as works in fresco-secco are not probably executed in this manner. The method may have been adopted in repainting parts, and this may have led to the idea that entire works were thus executed.

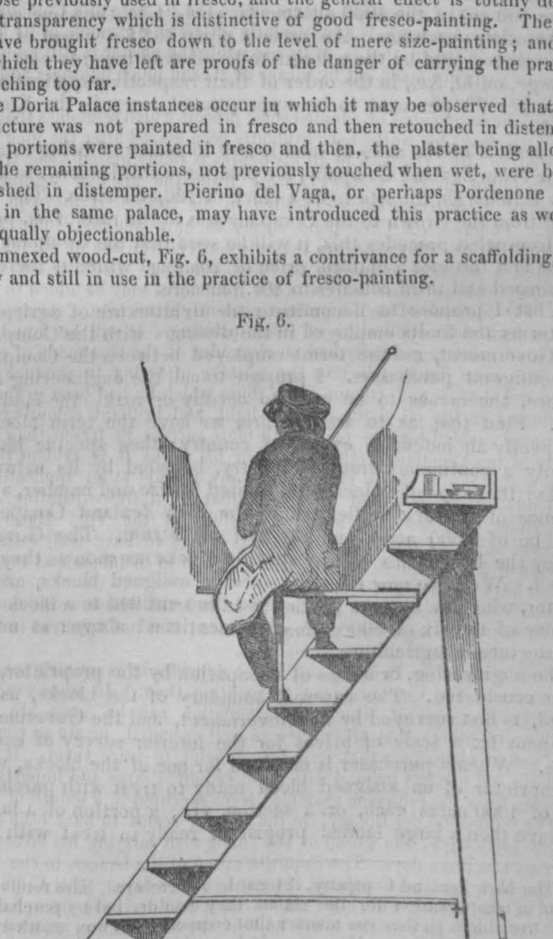
Fresco-secco is extensively used in Italy at present, and with great success: the chiaro-scuro decorations executed in this manner are excellent; but I found that at Milan, where I had an opportunity of examining some specimens, it did not bear washing like the Munich process. The method seemed the same, but the result differed in this respect, and I had no opportunity of seeing the actual process of paintings executed in this mode, in any other part of Italy.

At Genoa, where the paintings in the churches and palaces have no claim to be called frescos, although generally so described, a compound process has been followed in their execution. They were all commenced, or partly commenced, in fresco, but were finished in distemper, and size has been used for mixing the colours, as they can easily be removed by washing. The object of the Genoese artists has been to supply the fancied deficiencies of fresco-painting in point of colour; but, although they have succeeded in making use of vermillion, brilliant green, and bright yellow, they have not produced satisfactory works of art. The paintings are garish, and out of harmony; the colours subsequently added in distemper do not harmonize with those previously used in fresco, and the general effect is totally devoid of that transparency which is distinctive of good fresco-painting. The Genoese have brought fresco down to the level of mere size-painting; and the works which they have left are proofs of the danger of carrying the practice of retouching too far.

In the Doria Palace instances occur in which it may be observed that the entire picture was not prepared in fresco and then retouched in distemper, but that portions were painted in fresco and then, the plaster being allowed to dry, the remaining portions, not previously touched when wet, were begun nd finished in distemper. Pierino del Vaga, or perhaps Pordenone who painted in the same palace, may have introduced this practice as well as others equally objectionable.

The annexed wood-cut, Fig. 6, exhibits a contrivance for a scaffolding, &c. formerly and still in use in the practice of fresco-painting.

Fig. 6.



Steps with a moveable seat, and which has an iron hook or clamp on the end, and a leg equal in height to two steps.

THE ARCHITECTURE AND ENGINEERING OF AGRICULTURE; OR, COLONIAL DIVISION OF LANDS AND ITS RESULTS.

UNDER the above paradoxical and high-sounding title, I propose to draw the attention of the landed gentry and farmers of this country to the results of the proceedings of the Colonial Land and Emigration Office, in their treaties with the North, South and West Australian colonies; also the colonies established in New Zealand. The Crown granted to the New Zealand Company, established in 1839, lands to the extent of 160,000 acres, at Port Nicholson, in one block, or more; of such blocks six might be 5000 acres, and the rest 30,000 acres, each block to be a continuous tract bounded by the natural landmarks of the country. The government is to define and make the survey of the external lines of every assigned block; and arbitrators nominated by the Government are to determine the price of the interior survey of each block of 1000 acres. The land is to be sold progressively, as the surveys are completed, at one uniform price of 20s. per acre.

A second colony was formed in March, 1841, under certain stipulations, viz., the site to be chosen in New Zealand, (the site is since selected and named Wellington,) and to extend to 201,000 acres, which was to be divided and sold in allotments, each allotment to consist of three sections, one of 150 acres of rural land, one of 50 acres of accommodation land near the proposed town, and one of 1 acre of town land. Priority of choice to be decided by lot; the fixed price of each allotment to be £300, and upon which a deposit of 30*l.* was to be paid to the Company's bankers; and on the payment of the full purchase money, three separate land orders to be given, which were also to be determined by lot. The Company reserving a right to purchase 100 out of the 1000 allotments, subject to the same conditions as the other purchases. An amount equal to 25 per cent of the purchase money paid by the colonist to be allowed towards cost of cabin passage, outfit, &c., in the order of their respective applications; and the other 75 per cent to be appropriated towards the Emigration Fund.

A revival of the sales of land is now in course of being established by the New Zealand Company, for planting a third colony, to be called New Edinburgh, the site to be a block of 120,550 acres. The original grant from the Crown to the Company was at the rate of 5s. per acre; and from what precedes this, it will be seen that the Company charge in the first instance a uniform price of 20s., and which is increased in the second and third colonies to 30s. per acre.[1]

What I propose to denominate the architecture of agriculture, is the terms and limits employed in the dealings with the Company and the Government, and the terms employed between the Company and the emigrant purchasers. I propose to call the engineering of agriculture, the means to be used to occupy or make the land tenantable. First then as to architecture, we have the term block used, to specify an indefinite extent of country; then specific blocks, to specify a continuous tract of country, bounded by its natural land marks: these specific blocks are limited in size and number, as in the instance of the first settlement of the New Zealand Company; six may be of 5000 acres and the rest of 30,000. The Government survey the boundaries of the specific blocks as soon as they are assigned. We have now the term specific assigned blocks, and a proprietor, who now appears for the first time entitled to a block of land, say one of the six of 5000 acres, as mentioned above: so much for architecture of agriculture.

The engineering, or means of occupation by the proprietor, is now to be considered. The external boundary of the blocks, as before stated, is first surveyed by the Government, and the Government and Company fix a scale of prices for the interior survey of each 1000 acres. When a purchaser is obtained for one of the blocks, we have a proprietor of an assigned block ready to treat with purchasers of lots of 1000 acres each, or a section, viz., a portion of a large lot; we have then a large landed proprietor ready to treat with a purchaser for a section of land. Suppose the block to obtain a name from some peculiar feature of the country, as a mountain, say Mount Barker, the block then has a distinct name, and the term is changed to a district, as in this suppositious one, "The Mount Barker District;" this district will afterwards contain several surveys of 1000 acres each. Now supposing a purchaser has been found for a section of land, another name is then required for the allotment, say in this case, that it shall be called Dutton; the purchaser is then entitled to ask for a survey, which when complete, he will be ready to sell into smaller sections to be occupied by purchasing emigrants. On the arrival of emigrants, they generally employ an agent on the spot to select a section of land for them. Supposing the agent to have fixed a location, it would then be designated, in the phraseology of emigration, a section situated in New Zealand, the name of the country, in the Mount Barker district, in Dutton's survey, section 4208, or as the case may be. Next, suppose the emigrant's hut built, and he gives it a name, say, Balhannah, and others follow his example, we then begin to get rid of all sections and blocks, and in the mind's eye, have arrived in Her Majesty's loyal town of Balhannah, new Zealand.

But to return to see what has been actually done in carrying the above plans into effect; we first have the settlement of the New Zealand Company, then the district called Wellington in Port Nicholson. In this district in July, 1839, 1123 emigrants had arrived, and in March, 1840, the town contained 3000 inhabitants. The amount or extent of the land order in this case was for one acre of land and 100 acres of rural land. A second Company was then called into existence, which has subsequently merged into the New Zealand Company; they erected a settlement called New Plymouth, where the amount of land orders was reduced in extent to a quarter of an acre of town and 50 acres of agriculture, the whole block consisting of 57,500 acres, exclusive of roads, which was divided into 2200 town sections, containing in the aggregate 550 acres, and 209 suburban or agricultural sections, constituting the remainder. Before the emerging or amalgamation of the New Zealand and the rival Companies, the latter had sold 1000 town sections, 54 suburban sections, and 149 sections of rural land, (a third term now introduced for the first time;) and there have been sent out by the emerged Companies, to this, the second settlement, called New Plymouth, 308 male and 204 female colonists. The second settlement of the New Zealand Company, or third yet projected, is to be called Nelson, the site of which is not yet chosen; it is to be divided and sold in sections of 201 acres, viz., one acre of town, 50 suburban, and 150 agricultural, to be sold at the uniform price of 30s. per acre, which is at the rate of 7*l.* per acre for town lands, and so on.

From what has been previously said, it will be seen that one of the stipulations was, that the Company reserved the right of purchasing in the first instance nearly one half of the whole settlement, and by introducing three terms into the conditions, and consequently three different orders of land. The land orders sold in this country are for the suburban and agricultural, the town land being retained as a grevious monopoly, and with a non residence of thousands of miles.

In Mr. Jamieson's account of New Zealand, who was surgeon-superintendent of emigrants to South Australia, and to whose account I am indebted for many of the details of the size of blocks of land, he says, at page 142, "The owner of a land order entitling its holder to the first choice of a town allotment in the New Zealand Company's settlement of Port Nicholson, refused to sell his priority of choice for £1000;" and that sheep farmers now proceed beyond the boundaries of location by paying for the pasturage, or a squatting license. As a further proof of the establishment of the land monopoly in the colonies of the New Zealand Company, I may add the substance of a letter in the *Times*, September 26, 1843, and dated Wellington, March 9, 1843, from an officer of artillery, practising as a private surveyor; he says, "I wish something could be done, if not to tax the absentees, at least to give encouragement to *bona fide* settlers. The agents are confined by the absentees to grant no other terms for forest land than a lease for seven years," which is evidently of no use to the settler, the absentee coming in for all the settlers improvements almost as soon as any improvement has taken place. To Charles Dickens's Martin Chuzzlewit the public are deeply indebted, for the bold manner in which he shows up the system pursued in America, with regard to emigration, in his graphic description of taking possession of an allotment, he says, "At last they stopped—at Eden too—the waters of the deluge might have left it but a week before: so choked with slime and matted growth, was the hideous swamp which bore that name."

I will now state what has been achieved in Australia. New South Wales was colonized in 1788; West Australia in 1829; South in 1834, and North in 1838, and their populations in 1839, were respec-

[1] The New Zealand Company, it must be remembered, have received these grants in compensation for the claims they had derived by purchases from the native chiefs, in the same manner that compensation was granted to other holders of native claims. Moreover, it is to be observed that it is the practice for government to make sales of large tracts in the colonies to land companies at a reduced price, by which the government immediately receives a large sum, while the Company lay out a large capital in improvements, and the introduction of emigrants. On such principle large grants have been made to the Canada, New Brunswick, Australia, Van Dieman's Land, British American, South Australian, New Zealand, and Australina Land Companies. The New Zealand Company, we believe, do not purpose to take a larger sum than 5s. per acre for their own profit, the rest being devoted to emigration, education, churches, steam navigation, roads, harbours, &c.—EDITOR.

[2] Published 1842; Smith & Elder.

tively 78,000, 4,000, and 13,000; the population of North Australia is not given, but Van Dieman's Land is stated at 43,000. Australia has suffered equally with New Zealand in regard to the disastrous effect of a slow and inefficient survey, and from the injustice of the Special Survey Law prohibiting the cutting of wood and cultivation of the ground in unappropriated lands. The enormous amount of £4000 is requisite to get a special survey. The squatting system is mostly acted upon, which is a complete bar to the cultivation of the land for agricultural purposes, in consequence it only remains pastoral. The squatters pay a licence of 40*s.* per annum per square mile, and who upon their leaving are paid for the stock yard by the proprietor.

I have perused the letters of a relative who arrived in Adelaide, South Australia, in September 1839, and from whose experience and residence I am indebted for the following fact connected with the county as regards the system pursued with respect to lands, its price and suggested improvement. The cost of a Special Survey has been stated, which entitles the parties to a selection of as many acres as pounds are paid for the survey out of 23 square miles which is allowed to extend twelve miles in length, and any breadth; to make up the quantity, by this means the county is gutted of good land, and the remainder is unsaleable on account of its distance from a common crossing or reserved acre with water; it also prevents cultivation as good land is kept for sheep runs, to prevent which, as also the bad land remaining for ever on the hands of government, it is recommended to divide the blocks into 640 acres or square miles, and again to divide them into sections, say two of fine land with water, three hilly with water, and three wood and mountain, and to make the price proportional to the 20*s.* value, and to fix a maximum price for each description to prevent malignant bidding, at 40*s.* for fine land, 20*s.* for hilly, and 6*s.* 8*d.* for mountain. At present the special surveys generally bring from 50 to cent. per cent. profit after examined by the public, five per cent is paid on a survey to the party who discovers and marks the boundary of the proposed survey, and five guineas is paid to an agent for the selection of each section, which is a much cheaper and better plan than exploring the land personally, and if a special survey is required, a year will elapse in waiting for the leisure of the surveyor, and of these surveys already completed the proprietors pick out portions and delay the rest, and monopolize the district by reserving those containing water; and to prevent small holders of land orders coming and settling and sharing with the large resident proprietor the sheep runs, they have large districts surveyed, and then allow them to be occupied by squatters, the proprietor picking out all the best sections. To counteract this an attempt is sometimes made by an association of small capitalists joining and getting a special survey jointly, and fixing previously a sole arbitrator to fix the site of each location; but this plan did not succeed on account of the squabbles occasioned by the selection and the delay in fixing the site of each party to the joint survey although land has been obtained by this means that sold for 30*s.* to 70*s.* per acre. Unsurveyed lands in Mount Barker district of South Australia have been sold as high as £60 per acre. Of those land orders which have not been appropriated, the old ones have a priority, and are reserved to pounce on good sections as soon as they are surveyed, in preference to recent emigrants. Some of these land orders have been sold with three months credit as high as £70, and one a year old for £90, and one of older date for £100.

I will now proceed to give a description of the result of the emigration of my relative as regards his prospects, and a description of his location. He sailed from Scotland March 15, 1839, and arrived at Port Adelaide on the 30th Aug. following. On Sept. 26, he removed to Adelaide Town, and took a lease for fourteen years of a corner site, 79 ft. front, and 70 ft. deep, in Hindley Street, at a rent of 15*s.* per foot per annum. He bought, through an agent, an 80-acre section of suburban land for £240, in Mount Barker District,[a] on which he erected an inn at a cost of £90, built of turf, and thatched, which he has let for five years, at £100 for the first, and £125 for four following years: he has sold two and half acres in allotments, which yield £28 per annum: he has also sown 25 acres, which with seed cost £120; also one acre of whins, furze, or gorse, and planted 70 trees, viz. apple, pear, plum, peach, quince, apricot, citron, gum trees, and vines; he has also sown the following seeds—cherry, damson, cape gooseberry, hop, cocoa-nut, peas, beans, turnip, water and rock melons, pumpkin, cucumber, cabbage, sixteen varieties of greens, potatoes, plum, orange, grape, cotton, silver tree, capsicum, and aloes.

The thermometer in the shade stands at 76° to 90°, and in the sun at 115° to 120°. In the colony of South Australia there are about 12,000, although Mr. Jamieson says 15,000 inhabitants, and in Adelaide alone one-half reside. The price of land in town is from £8 to £20 an acre. In the town of Adelaide the streets are laid out rectilinearly, there being about three houses on each acre; it is divided into two portions by a valley, in which runs the chain of pools called the River Torrens: the intervening ground is reserved as a common. Seven miles is the distance to Port Adelaide, the nearest point at which vessels can load. The principal street is Hindley Street, three quarters of a mile long, and its continuation, Rundle Street; but King William Street, leading from the Government House and Post Office, will be the most superior. Currie Street, next Hindley Street, to the south, is being filled up, but not closely; and beyond it houses are erected having little appearance of a town. Rosina Street is the name of another, in which my relative temporarily set up his tent. In Hindley Street a site, 25 ft. × 18 ft., was let for two years on lease at a rent of £83 per annum, and £40 was paid for the lease: another, with a frontage of 80 ft. × 100 ft., was let for 50*s.* a foot per annum.

The following is a description of the buildings. The Capitol is a mud house, with a reed roof, a sheet for a door, and an apron for a window, the Pisé is cornered with brick. There are a few brick houses. The English church is built with rubble stone, and is already in a dilapidated state, and has been partly rebuilt with a square tower at one end, with a shingle pyramid and transept intersecting the other. The Methodist building is ornamented with four Doric columns and pediment the span of the roof. The Independents are seeking subscriptions; and the Seceders and Kirk of Scotland are also about erecting places of worship. In the vicinity are several Germans who have settled, carrying with them their peculiarity of construction: four miles north 200 are settled on the division of labour and profit; and at a distance of 28 miles is their settlement of 2000 acres called Klemzig: it is a long street, with isolated houses in gardens, with the gables towards the street. They have another settlement eighteen miles off, and which was one of the first special surveys: it is named Hansdorf; it is not so clean in appearance as Klemzig.

The port where the Post Office and bonded stores are is badly situated, boats of two feet draught grounding in the mud. Large ships lie at the intersection of the north arm of the creek nine miles from port; but four miles higher up many ships lie there having fifteen feet water. The height on the bar at top of tide is sixteen feet. To remedy the inconvenient situation of the port the South Australian Company is making a road to the creek, and propose to erect jetties. A canal is already cut through the swamp, and a road is making alongside, towards which each cart visiting the landing brings a load of sand from the hill as toll. The creek is called the Sixteen-mile Creek, and for twelve miles is lined with mangroves, the distant hills backing the landscape. The range is a gradual rise from Encounter Bay: Mount Lofty is six miles from town, and is 2200 feet high; Mount Barker is a few feet less, and commands a view of a dozen surveys. Both these mounts have given names to the districts adjoining. The roads are laid down straight, with cross roads every four or six sections.

Mr. Jamieson, in his work before alluded to, mentions crossing the hill range in Mount Barker District with two Scotchmen, one of whom was my relative, and from whose letters I have collated the preceding notes. They took the old Tiers road by Mount Lofty, and visited the Cattle Company's station, and passed through Meadous' Survey, Smallies' Survey, and the Three Brothers' Survey, on the bank of the Onkaparinga or Angus River, and then proceeded 25 miles south on the Wollinga River, where the land is good, and some eligible sections taken. The Angus River and Hindmarsh River, the latter near to Lake Alexandria, are the discoveries of Mr. Cock, who is fully described in Jamieson's work as a successful emigrant.

The colony was founded in 1836, and in a Parliamentary Blue Book published in 1842, the present governor states that the entire population is 16,000, of which there are in the town 8474; and that there are 63 public-houses; and that in 1841 the government revenue was £30,000, and expenditure, £150,000; and that 3000 acres were under cultivation; and that a jail, which is incomplete, had been erected at a cost of £32,000, or more than one year's revenue. During 1842, the land under cultivation had increased from 3000 to 19,000 acres, and the crops were valued at £98,000; so that, from the above account, the trial may be said to be over, and the colony fairly planted; the trials that have been undergone being the reverse of Dickens' Eden, and more like the terse language of Scripture, Australia being a land "wherein no waters be;" at least the fact of water being reserved as a monopoly is *prima facie* evidence of the scarcity of it.

In conclusion, the division of the land by arbitrators, the effect of nefficient survey, the Company's reserves, and the squatting system,

[a] Section 4208 in Dutton's Survey, near Onkaparinga or Angus River and road to Smallies survey, and passes one end and the ride or road to Mount Barker in which 8080 acres are surveyed.

have all been alluded to; as also the variation of land orders in extent and a description of the land, the terms on which the absentees only will grant leases of wood lands, and the restrictions imposed as regards cutting wood, and the cultivation of the ground, and the enormous amount of rent charged for the best town sections, have also been stated; and I will leave it to your readers to say whether the freedom anticipated on emigration is likely to be obtained; and the statement of the governor of South Australia, as to the number of public houses, I think sufficient to prevent the man of retirement and fine feelings to seek for a home there. Instances are mentioned, from Mr. Jamieson's work, of sellers of rum and bullock drovers realizing large fortunes in almost no time, from preying on the new arrivals. This also shows that there is no association—no sympathy with new comers; and that the fight for a living will have to be continued with even greater vigour than in this country; and it must also be considered that in individual gain originated the scheme.

With respect to the price of manual labour, the emigrant is paid 9*s.* a week and food, until he finds a master, and the wages given by masters is from 15*s.* to 21*s.* a week and keep; and men working by job-work will earn from 7*s,* to 10*s.* a day; and wood-splitters will be enabled to earn on an average 20*s.* a day, and instances are known of 50*s.*, 60*s.*, and 100*s.* per day having been made. The cost of fencing seems almost the standard of wages—ten to fifteen yards being a day's work at a cost of 1*s.* 6*d.* to 2*s.* per yard.

I would have sent you a list of provisions for emigrants on the voyage, as also a tariff list of purchases made and profit realized by the sale on arrival, but your Journal, not being exactly the medium, I forbear doing so.

As far as my individual opinion goes, I am so prejudiced in favour of the crowded city, and like so well to be on the full tide of civilization, that I am almost inclined to think, with a quondam friend, who said "he would rather be executed in London, than die a natural death elsewhere." I hope what I have already said will tend to give parties the means of better judging of their probable position on their arrival in the colonies.

St. Ann's, Newcastle-upon-Tyne. O. T.

REVIEWS.

Specification of a Patent granted to P. M. PARSONS, *of Waterloo Bridge Road, Surrey, for "certain improvements in steam engines and boilers, and in motive machinery connected therewith, &c."* G. Hebert, Cheapside.

Mr. Parsons has evidently great expectations and hopes to ascend to the pinnacle of fame by his inventions—of which consummation we have very considerable doubts. If we were to judge of his abilities by the extent and number of his improvements, we should rise from the perusal of his pamphlet with a high sense of his merits; but unfortunately, if the wise saw was ever applicable, it is so here—that "what is new is not useful, and what is useful is not new.

But to show that we are not among those who would condemn all novelties, without enquiry and examination, we will point out where Mr. Parsons has encroached on the property of others, and where his own ideas (and they appear to us to be few) are in a practicable point of view untenable and useless.

Mr. Parson's patent is divided into eleven branches, the first of which contains eleven claims; the second branch has two; the third the same; the fourth one; fifth one; sixth five; and the seventh, eight, ninth, tenth, and eleventh, one claim each; in all no less than *twenty-seven distinct claims or inventions*, so that our readers will perceive we have taken upon ourselves a somewhat laborious office, even if we notice only the most prominent. The first branch applies more particularly to the employment of high steam and locomotive boilers, surface condensers, and double cylinder engines; for marine purposes, of all these suggestions, one only is new, the locomotive boiler; we use the term in its strict sense, and as it is evidently meant to be by the patentee—namely, constructed on the same plan as those employed on railways, and as he has drawn them, Figs. 1 & 2, sheet A. Now, we believe it is generally known, that for three or four years past, boilers on the locomotive plan have been adopted in steam vessels on the river Thames and elsewhere, and although generally, and more appropriately, termed "Tubular Boilers," are in all essentials exactly identical in principle with the railway locomotive boilers; and we have reason to know such are now working under a much higher pressure of steam than the public have any conception; or is a knowledge of the value of *expansion* new, either in theory or practice: and Mr. Parsons will find that we have made much greater progress in the art than he appears to have any knowledge of.

There can be no doubt, that when the proper time arrives, when by safe and careful experience we can make a further advance in the use of high steam, by an increase in the amount of pressure, that a considerable saving will arise in the consumption of fuel, and a decrease in the necessary boiler room; theory has told us this for many, many years past; but in these matters, theory awaits upon practice, and the state of the latter may be judged of from the recent works of some of our most eminent engine makers.

But is it probable that the railway locomotive boiler, as figured by Mr. Parsons, will be introduced on shipboard? We think not, because their shape is that of least capacity compared with space occupied; and experience has detailed better forms and arrangements, quite capable of bearing as great pressures, and which enables the engineer to occupy to advantage all the space allowed for his machinery. If, therefore, Mr. Parsons does not strictly adhere to his specification in this particular, he will merely follow in the footsteps of Penn, Seaward, and others too numerous to enumerate; and his invention is therefore "useful but not new."

We could have wished that some scale had been attached to the drawings in the pamphlet, so that we might have brought to bear upon Mr. Parsons' schemes the test of figures, combined with practical experience of the requirements of marine machinery; and it appears to us, we could have satisfactorily shown that he is far behind both in his theory and practice of such engineering. Dismissing, therefore, the boiler, we pass to the engine, and we have (although disguised by Mr. Parsons' ingenuity), nothing more nor less than Hornblower's scheme, as patented by him in 1781, (see Farey, page 384, and Gregory's Mech. Vol. II., page 385;) or perhaps more strictly speaking, we should say Woolf's engine, inasmuch as Mr. Parsons proposes to use high pressure steam in his small cylinder, and expand it in his large one;[1] Hornblower, on the contrary, employed low pressure steam. But, Mr. Parsons' complicity is beyond all endurance, valves upon valves, and steam and vacuum passages without end, the former placed in situations where they cannot be conveniently examined, the latter rendering the casting of the part a most difficult and critical proceeding; it further occurs to us, that by the employment of *two* piston rods, he somewhat encroaches on Maudslay's patents of 1840 and 1841, (see our *Journal* of March 1840 and October 1841,) and is in this and in its method of securing the lower end of the connecting rod, an exact infringement upon the designer of the *Prince Albert's* engines, whose name we forget, but believe to be by birth a Swede; and between who and the Messrs. Maudslays, we hear, a tacit understanding exists, arising from mutuality of invention, or rather adaptation or use, for we cannot dignify such things by the term "invention."

And what are Mr. Parsons' condensers but *surface condensers?* differing only in detail from Cartwright's of 1797, from Mr. Watt's gridiron condenser, and later still from Mr. Hall's; the latter employs pipes, Mr. Parsons corrugated iron plates; disbelieving, as we do, the advantages said to arise from the use of surface condensers, we, however, cannot allow this opportunity to pass without bearing our small tribute of admiration to Mr. Hall, for the ingenious and scientific way in which he has carried out his improvements upon Cartwright's surface condensers; for although it was formed of plain plates, we contend the principle is the same, Mr. Watt introduced pipes, and tried numerous experiments, but failed. We have yet to learn that Mr. Hall is more fortunate; but be that as it may, his arrangement for supplying the loss of distilled water is really beautiful, and upon which Mr. Parsons' is a sad parody and burlesque.

We have hitherto principally treated of what Mr. Parsons does *not* claim *per se;* but *collectively*, as an entire machine; let us endeavour to trace out what is his individual merit, and how far he has added to our stock of knowledge.

The *eleven* claims in the *first branch* put us in mind of what is called "ringing the changes," being a species of involution of surface condensers, high pressure, and double expansion engines. The third claim in this branch, is, we believe perfectly new, whether useful or not remains to be proved; we allude to the double action air pump, with separate valves and offices, the one at bottom to remove the condensed *water*, that at the top to pump away the air and uncondensed vapour accumulating in the condensers; it is but an experiment, and we have doubts of an advantageous result, particularly when we reflect that the single acting air pump in the common engine produces a vacuum of $27\frac{1}{2}$ in. frequently 28 in., the condensed water being at a temperature of 100° or thereabout, which experience shews to be the best for

[1] We do not enter into the question as to the advantage of expanding in *one* cylinder, as Watt, or in two, as Hornblower.

economical purposes. By Mr. Southern's rules (an authority above question) as given by Farey, page 73, it follows that the vapour arising from water heated to 102° is equal to a pressure of 1·97 in. of mercury, therefore taking 27·5+1·97 we have 29·47 in., or only 0·53 in. below the mean barometric column in this country, which we opine, leaves a very small margin for inventors. We now pass to the *second branch*, which describes a double cylinder engine. Woolf again, with a small spice of Mr. Joseph Maudslay's patent of 1841 (before adverted to) we have here, two piston rods and an annular cylinder, the internal cylinder to be used *à la Woolf*, for high steam; besides a patent by Mr. Gillman has been already secured for using two cylinders one within the other, and adopted for the same purposes as Mr. Parsons proposes.

Without being hypercritical upon descriptive drawings to so small a scale, we shall content ourselves with remarking, that we cannot see how Mr. Parsons means to fit, adjust, and repair the small sliding valve, E F, Fig. 7, sheet A; or how to make good the wear and tear of the valves, N and M, with their *triple* faces, or to secure and make tight the cylinder cover; and lastly, how all this complication is to be manipulated and worked? These are practical points which suggest themselves to us, for the means described in p. 6 are, in our opinion, totally inefficacious.

The *third branch* comprises a scheme that really provokes our cachinnation;—we believe it to be entirely new, although Mr. Parsons does not claim its leading principle—the reciprocation of the *cylinder* upon a *fixed* piston, stating it to have been used: if so, we conceive it must have been on a very *small scale*.

The *fourth branch* consists of an arrangement of steam engine, "having for its object the better application of the power for driving screw propellers." It is on Woolf's plan, but evinces considerable ingenuity;—but it is objectionable on account of the spur gearing, which has been found the great difficulty in applying and working screw propellers.

The *fifth branch*, for disconnecting paddle-wheels from the engines, so that they may revolve when the ship is under sail, would be expensive in fitting, and useless in practice. Many other schemes are known of far greater superiority; among others, that of Trewhit is prominent.

The *sixth and seventh branches* introduce more complication where there is necessarily too much already, namely, in the locomotive engine.

The *eighth branch* is an invention for supporting the main plummer blocks of marine engines. This is verily an "invention," for we feel assured nothing of the kind was ever seen before. This, like the third branch, assures us of what we previously had an idea—that Mr. Parsons's ingenuity far exceeds his practical knowledge.

The *ninth branch*, an improved packing for pistons and shifting boxes, like the fifth, is useless, because far better means are in use, as those of Maudslay and of Robert Napier.

The *tenth branch*, an improved cock aud plug, is absurd.

The *eleventh branch*, for preventing cams turning round with the shaft, is absolutely preposterous, because it can be, and is done, by more simple arrangements.

This, then, completes our analysis of Mr. Parsons' patent. We cannot, however, conclude without protesting against this wholesale mode of making up a patent, and observing that he cannot reconcile, with the honour and dignity of the profession, thus bringing together other men's inventions, disguise them under a thin veil of doubtful improvement, and make the compound the subject for a patent.

Weale's Quarterly Papers on Engineering, Part I. London: John Weale.

Weale's Quarterly Papers on Architecture. Part I. London: John Weale.

Mr. Weale, having succeeded so well with some of his annual publications, particularly the papers of the corps of Royal Engineers, has now commenced two quarterly miscellanies, one devoted to engineering, and the other to architecture, as the means of preserving those papers which, without being of sufficient bulk to justify an independent publication, are yet too long for our columns, or require a greater extent of illustration than we can devote to any one subject. We see that the design includes scientific memoirs, the lives of eminent professional men, republications of American works, and translations of important communications from the French, Dutch, and other foreign languages. When it is considered that the works will each form a handsome volume at the end of the year, expensively illustrated, and at a moderate price, we are sure these new enterprises will receive that support from the two professions which they well merit.

The engineering part not inappropriately commences with a copious life of Brindley by Mr. Hughes, C. E. It gives full details as to his works, and is illustrated with a copper-plate portrait. Another memoir succeeds this, namely, one on Wm. Chapman, C.E., for whom is claimed the invention of the skew arch, first applied by him, in 1787, on the Kildare County Canal in Ireland. Originally employed in the merchant navy, his attention was early directed to hydraulic engineering, which, on the advice of Watt, Boulton, and others, he determined on pursuing as his profession. He was consequently employed on a number of canals and docks, and, among others, on the London Docks. He was also the author of several useful professional works, and of many valuable inventions and improvements in mechanical processes, particularly in rope-making, and the shipment of coals.

We have afterwards a paper on the dredging machine, with three engravings, and entering into the history of that invention, but to which, as it is likely to be the subject of controversy in this *Journal*, we will not at present enter. The plates describe a machine constructed under the direction of the late Mr. Rennie, in 1802, for raising mud out of Messrs. Perry's dock at Blackwall, and another used at the Hull docks in 1808. In this paper it states that "the piles (600 in number) for the coffer-dam of the Wapping entrance of the London Docks, constructed by Mr. Rennie, were driven by one of Boulton & Watt's eight-horse engines in the year 1801. Next comes an account of the engines of the Russian war steam frigate, the *Kamschatka*, constructed at New York by Messrs. R. & G. L. Schuyler. Four plates illustrate this subject, and a description is given of several peculiarities in the construction, for which we cannot say much in its favour. We will, however, let the engineers give their own reasons.

"In the United States, the most aproved method of using steam is expansively, that is to say, by having a high pressure in the boiler, cutting off the steam from the cylinder after the piston has performed say one quarter of its stroke, and allowing this high steam to expand through the remaining three quarters of the stroke. To this system to work to the best advantage very long cylinders are required.

"Having determined upon adhering to this method, so successful in our river steamers, it became necessary to adopt some plan by which the length of cylinder could be preserved without elevating the engines above the deck. or cramping the action of the connecting rod, as is seen in some English government steamers. By reference to the drawing, you will observe that any desired length of stroke can be obtained without adding to the elevation of the engines, and also that the connecting rod has great length and free action. The advantages of placing the cylinders in a horizontal position, firmly secured to the keelsons, and bolted down through the hull, are also very great. The strain of the engine is fore and aft, which tends greatly to relieve the ship. The engine takes up much less space in width than any other; there is consequently room for coal-bunkers four feet wide on each side, thereby rendering the engines completely shot proof. In this plan we retain vertical air pumps, force pumps, and valves. The steam and exhaustion valves are of the kind commonly used in the United States, known as double balance valves. The valves used for expansion are of our own contrivance, and peculiar to this ship; they are worked by a separate eccentric and rocker shaft, which is so set as to follow the motion of the steam valve, cutting off the steam at any point of the stroke which may be desired; they can be thrown out of gear instantaneously, without stopping the engine. The triangle or half beam, which forms the connexion between the piston rod and the connecting rod and cranks of the engine, can be so arranged, by altering the centres, as to make the cranks of any length which is thought most advisable, without reference to the length of stroke of the piston. In the case of the Kamschatka's engine, the cylinders are 62½ in diameter, and have ten feet stroke, while the cranks are but four feet in length, and you will readily perceive that any leverage lost in shortening the crank is exactly counterbalanced by the gain upon the half beam. The steam is cut off at one third of the length of the cylinder. The number of strokes of the piston are from 26 to 34 per minute—on an average 30; thus requiring 4260 cubic feet of steam per minute, of an average pressure of 12 lbs. per square inch above the atmosphere. She has four copper boilers, (constructed for burning anthracite coal), each 10 feet long, 12 feet 6 inches wide, and 14 feet high; the flues all centering in one chimney, 7 feet in diameter, and 46 feet high above deck. Each boiler has four separate furnaces; the heated current is taken from each furnace through 400 copper tubes, each 28 inches long, and one inch in diameter in the clear. From any one of these furnaces, by a peculiar construction of a revolving grate, the coals can be instantly dropped, and the tubes in that furnace can be swept out and cleaned while all the other furnaces are in active operation. Some doubts were entertained by engineers in this country as to the possibility of keeping these small flues tight, and also as to their choking up on a long sea voyage. Our experience in the *Kamschatka* completely settles that point. Of the 6400 tubes in her boilers, not one is known to have failed in any respect. After passing through these small tubes, exposing an immense quantity of fire surface, the heat is carried by ordinary cross flues through the upper part of the boiler over the arch of the furnaces to the chimney. The consumption of anthracite coal in the *Kamschatka*, to furnish the supply of steam above stated, varies from one ton to one ton and a quarter per hour. We would also remark, that the same boilers answer, though not so perfectly, for the consumption of bituminous coal. On the voyage from Southampton to Cronstadt the latter coal was used, the average consumption being 32 tons in 24 hours.

"The plan of engine used in the *Kamschatka*, and known as 'Lightall's Patent,' is gradually coming into general use in these waters. A new steamer for the Hudson river, now building, 325 feet long, which is expected to excel in speed all others, is to be supplied with these engines, the proprietors having already tested the plan for several years in the largest and finest boat on that river.

"The *Kamschatka*, planned and constructed by us for the Russian government, is a man-of-war steamer of the largest class, carrying a heavier armament than any steamer. She is a double decker; carries on the main deck eighteen long 36-pounders, and on her spar deck two guns of 10-inch bore, one forward and one aft, revolving in whole circles; and two guns of 8-inch bore, revolving in half circles. Her length is 246 feet; beam, 45 feet 6 inches; depth, 24 feet 6 inches; tonnage, 2049$\frac{a}{95}$; draught of water with crew, ammunition, provisions, water for a cruize, and fuel for 26 days, 16 feet. The performance of the ship, in a very stormy and tempestuous voyage from New York to Cronstadt, in the months of October and November, 1841, was entirely satisfactory. Her rate of speed was from 10 to 12, and occasionally 12½ knots per hour. Under sail, her engines being disconnected, she has made 197 miles in 24 hours. In the heaviest weather she was steered with perfect ease, and shipped no sea during the whole voyage."

Mr. Joseph Gill has contributed some hints and improvements of the steam engine, which require to be separately considered.

We see that for the next number much matter of interest is promised by Mr. Weale, and particularly papers on the light-houses of England, France, and America, the hydraulic works of Holland, and the ship-building of the United States.

The Quarterly Papers on Architecture commence with "an Essay on those Powers of the Mind which have reference to Architectural Study and Design," by Mr. George Moore, well known for his talent and abilities in architecture, as well as the fine arts generally.

The next paper refers to the Greenwich poor-house, by Mr. R. P. Browne, the architect of the building. It is accompanied by four plans and an isometrical view. The arrangements for classifying the inmates appear to be well carried out, and are of an extensive character, affording accommodation for near 1200 persons, the cost being, on an average, about £24 per head. The following is the cost of the land and buildings:

				£	s.	d.
Purchase of land and expenses				1,865	2	6
Forming a sewer to the river, about 250 feet, and other works				1,200	0	0
Contract for house	£18,674	0	0			
Additional works in buildings and fittings	3,664	0	0			
Artesian well and three-barrel pump	208	11	11			
Boilers and furnaces for washing ..	68	5	0			
Steam cooking apparatus, eight baths, boilers, stores and fenders ..	720	0	0			
Additional works for enlargement of infirmary department . ..	1,546	0	0			
				24,880	16	11
				£27,945	19	5

The next paper is the Life of the late Mr. Morrison. architect of Dublin. We learn from the memoir that William Vitruvius Morrison was a kind of hereditary architect, his father, grandfather, and great grandfather having also exercised the profession. Sir R. Morrison, the father of William, and under whom he was brought up, is also a subject of the memoir. William Morrison, according to this paper, was the first to introduce the Tudor style into Ireland in modern days, and was the designer of a number of the finest modern seats in Ireland, principally in the style just named

We next have four plates of stained glass windows, selected from the ancient churches of York by Messrs. Bell and Gould, architects. The plates are beautifully printed in colours by Mr. Cheffins, and have a very rich effect. The concluding paper on the Primitive Churches of Norway, with six drawings of doors, with carved frames and frontispiece in wood, highly ornamented, and of a peculiar arabesque character, are well deserving the study of the architect; and, as the author observes, they afford hints and ideas that might be turned to account, and, among other purposes, for ornamental metal work.

Ecclesiastical Architecture. Illustrations of Baptismal Fonts. Part I. London: Van Voorst.

The present ecclesiastical fever will do some good if only for the interest it excites in architecture and its details. Parsons are looking about them, brushing off the whitewash, and brushing up antique fonts, pulpits, screens and pews, a zeal which we hope will also be caught by the Church Building Commissioners. The old rule was when one of the large workhouse buildings, misnamed churches, was run up, to stick in a few sheep-pens or pews, and consider the job completed. Attention to details, or the necessary ornaments, was not to be expected, the same ice-fiend ruled in cold propriety in the interior who had pared the outside to bare walls, simplicity, or as we should call it, nakedness, reigned supreme, and the carpenter and joiner finished tastefully what the bricklayer and labourer had so artistically begun. We hope, however, that the reign of the Goths is checked, and that we shall see better things. The present work will do much good in this respect, for it gives some excellent examples of what may be done in all styles in that neglected attribute of a church the font. The present number contains no less than sixteen engravings all by first rate artists, and produced with that excellence Mr. Van Voorst knows so well how to display in his illustrated publications. We hope to see this work carried to a great many numbers.

RAILWAY WORKS—ABBOTT'S CLIFF, DOVER.

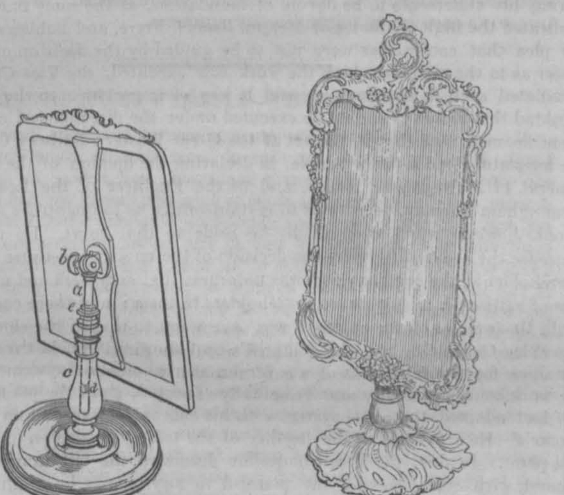
We are indebted to Mr. Hodges, engineer of the South-Eastern Railway, for the following details. Another of those blasts by which the progress of the works have been so greatly facilitated, and having for its object the clearing out the angle of the slope to form the face of the Abbott' Cliff tunnel, was intended to have been effected on Thursday; but, from some unaccountable cause, the circuit of one of the voltaic batteries was prematurely completed, discharging a portion of the mines, and leaving the rest unsprung. In this blast (although minor in point of power, yet, as a piece of engineering, much more difficult than any of the preceding), 3600 lbs. of gunpowder were to have been exploded. This was divided into 28 charges, varying from 28 lbs. to 900 lbs. each, and placed upon two platforms, 100 feet apart; the upper having 12, and the lower 16 charges, the whole of which were intended to have been simultaneously ignited. The arrangements had all been most carefully made by Mr. Hodges, assisted by Mr. Graves, and it is impossible to account for the partial and premature ignition which took place. So, however, it was; some of the mines first exploded, and Mr. Hodges, finding that to be the case, completed the circuit of the whole of the batteries, by which the 12 mines on the upper platform were discharged. Upon examination, it was found that the spoil, caused by the prematurely exploded mines, had disarranged the whole of the wires connected with the lower mines, and, of course, prevented their being discharged until this spoil could be removed. The dislodgment effected by the upper mines is precisely what was required; and there is little doubt but that the lower mines, when discharged, will produce the desired result, although not fired with the upper. This partial check, for it can scarcely be called a failure, is the first with which Mr. Hodges has met in the course of the numerous explosions which have been planned and executed by him during the progress of the works, and by which so many thousands of pounds and so much time have been saved the company and contractors. Since the above was written, the lower mines were discharged, and the result is precisely what was desired by the projectors. The works are progressing here with great rapidity; the outward piles of the viaduct are now been driven, and its completion will take place during the month. These piles go completely into a rocky substratum, and give great security and firmness to the work. The sea-wall is in a state of rapid completion, and, when erected, will prove a most perfect barrier to the inroads of "Davy Jones," from whose attacks, such is the natural formation of the beach, we think there is nothing to be feared. The Archcliff-fort Tunnel will be finished next week; and the preparations are now being made for laying the permanent rails in the Shakspeare Tunnel. According to appearances at present, we have little doubt that Mr. Cubitt's expectation of opening the line to Dover before the end of next month will be realized; at all events we feel quite satisfied that the year 1843 will witness the carriages of the South-eastern Railway running to Dover.—*Dover Telegraph.*

NEW INVENTIONS AND IMPROVEMENTS.

BIELEFELD'S PATENT DRESSING GLASS STAND.

In the construction of glass stands every kind of form has been given to the frame and pillar supporting them, but it is somewhat remarkable that no attempts have been made to improve the principle of construction: in seeking graceful forms we appear to have hitherto forgotten to inquire whether the *mechanical* structure may not be improved;—a circumstance the more remarkable, as the usual mode is admitted by every one to be very faulty. The glass in all cases hangs on two stems, and turns on two pins: after leaving the workman's hands, for a few days or weeks, the glass turns obediently to our will, and retains the desired angle; but soon a little obstinacy shows itself; the glass seems bent on resuming its vertical position: a turn is then given to the screws to keep it in its place: again another and another turn gives us a brief control over the pertinacious mirror; but it is soon found that every turn of the screw increases the evil, for, in pressing against the glass, it mechanically forces the stem which holds it out of its proper upright position; and thus it is at length compelled to leave the glass, and take its own course, or to endeavour to resist it by wedges, props, or other shifts. Never yet, however, has this difficulty been overcome; for, by some strange oversight, inventors have never sought a new principle of hanging. Mr. Bielefeld, however, the inventor of the article before us, which he calls the *Quâquâversal* Glass Stand, has at length adopted the right course with complete success.

It will be at once seen that the simple stem which holds up the mirror can be raised or lowered, so that it may be used either sitting or standing; that the mirror itself can be turned to the right or the left, and set at every possible angle: and it is also obvious that the screw which keeps the joint tight can never cease to do so, as it acts on a principle the very reverse of the screws on the old plan. The accompanying figures and description will explain the construction.



Description:—*a* is a simple stem, sustaining the mirror, which can be placed in a more or less vertical position by means of *b* a joint fitted with a thumb-screw, to admit of being tightened or loosened at pleasure. *c* is a hollow shaft, or column, in which the stem *a* is made to slide freely. *d* is a felt collar, fitted on the end of the stem *a*, to ensure an equal bearing on the hollow column. *e* is a collar, turning freely on the hollow column, and is fitted with a screw stuffing-box, which allows the mirror to be fixed at any degree of elevation, and at the same time admits of its being turned either to the right or to the left. *f* is the foot, which is made to screw off or on, by which means it may be packed in the smallest possible compass,—a great desideratum in exportation.

ARMSTRONG'S HYDRO-ELECTRIC MACHINE.

The machine which, under the above name, is attracting crowds of admirers to the Polytechnic Institution, is an apparatus contrived by Mr. Armstrong (an enthusiastic scientific gentleman of Newcastle) for the purpose of collecting, on a large scale, the electricity generated by the friction of partially condensed steam. The vivid streams of electric fluid which are drawn from every part of the machine, and which appear almost inexhaustible, fill the reflective beholder with a mixed feeling of awe, of pleasure, and of pride; of awe, at beholding so vast an accumulation of a power so fearful—of pleasure, at its novelty and beauty—and of pride, that man has attained the power of making subservient to his will, this mysterious agent, apparently more concentrated than the forked lightning, one shock of which, if passed through his body, would stretch him a lifeless corpse. The victory of mind over force is indeed daily extending, whether it be exercised over beasts or the elements, whether steam or electricity.

This discovery, like many others which are now changing the pursuits and opinions of men, is of very recent origin, bearing date but two or three years ago. It appears that an attendant to a fixed engine at Newcastle, whilst standing in a current of steam rushing from a leaky valve in the boiler, extended his hand towards it, and perceiving a slight spark, concluded that the boiler was full of fire. Mentioning his suspicions to Mr. Armstrong, the latter tried it, and from thence proceeded with experiments, which have ended in the production of the present machine. It is said that from the fall of an apple, Newton worked out his beautiful theory of gravitation—that the swinging of a lamp in a cathedral, suggested to Galileo the laws of the pendulum—and although we would not put this new discovery on a par with these, yet it is of the same nature. Thanks to the wide diffusion of scientific knowledge, there are now multitudes of minds who, imbued with true philosophic zeal, beholding an accident or an isolated experiment, which formerly would be viewed with the eye of superstition or considered as the result of chance and unaccountable, would immediately consider its cause and effect, and see in what manner it might assist in the advancement of science.

Description.—It may be considered to consist essentially of three parts; a boiler 7′ 6″ by 3′ 6″ from which the steam passes, by two tubes in the top, into the 2nd part, a long horizontal tube, from which issue 46 curved pipes, terminated by wooden nuts with orifices $\frac{1}{16}$ of an inch, allowing high-pressure steam, mixed with a great quantity of condensed water, to rush upon the 3rd part, the conductor, which is composed of four rows of brass pins, contained in a zinc box, 7 ft. long by 1′ 10″ wide. The boiler is insulated by standing on six strong glass legs; the funnel is suspended, and when the machine is in action is raised up; the conductor is in electric communication with the earth.

Theory.—It appears from the investigations of Dr. Faraday, that no portion of the electricity is due to the steam; it acts only as the driving power to the particles of water which are condensed in the curved pipes. That, in fact, it arises from the particles of water, rubbing against the small orifice from which it rushes. Positive electricity is excited, which the conductor instantly carries to the earth; the water then, in order to return to its normal state, robs the boiler of its share, and leaves it in an intensely negative state. Thus we see, that although derived from a new source, we have not to add to the list of thermo, magneto, chemico, and frictional electricities, as the latter is quite sufficient to account for it. It may, indeed, be compared to the common electrical machine, by considering the water to correspond to the glass, and the boiler and tubes to the rubber. The Doctor has shown, by experiments as simple as conclusive, that dry steam or air elicit no electricity, but that if either hold in suspension particles of liquids or solids, electricity is excited; that in the case of water, it must not contain a conducting substance, or none would be obtained; and that if it contain oil, turpentine, or other resinous substance, it produces electricity of an opposite kind.

It appears strange—the only difference between steam and water at 212° being the latent heat the former contains—that electricity cannot be produced from both; and it would lead us to consider steam as being a definite compound of oxide of hydrogen + electricity + latent heat, the latter being in a much weaker state of combination, and always being parted with before the electricity.

The reader is, we doubt not, aware that Faraday discovered, some years ago, that carbonic acid gas, by being generated in immensely strong vessels, may be compressed into a liquid state; that Thilorier discovered that, if this liquid be allowed to rush into the air, part of it passes into the state of gas, and, by the cold produced, freezes some of it into the solid state. Now it would be an interesting experiment to ascertain if, by insulating the apparatus, electricity could not be collected. The circumstances appear so similar, that we feel convinced that such would be the case. We should like to hear of Mr. Addams, who has greatly improved upon Thilorier's apparatus, whether he has tried it, and, if so, what is the result.

The exceeding beauty of the experiments performed by this machine is very striking. Water and other liquids have been decomposed by it; and every day, beyond the ordinary experiments with tin foil and wires in various shapes, gunpowder is exploded, and shavings ignited, and the aurora borealis imitated most splendidly. Metallic leaves and wires are exploded by discharges from the large battery, which is charged six times in one minute. Although the battery can be charged in one-fourth of the time by this machine that it could be by the colossal plate machine that they used formerly, showing, therefore, four times the intensity, it appears that the striking distance, that is, the length of flash, is not anything like so long.[1]

Mr. Bachhoffner, who gives an exceedingly clear lecture on the machine, drew attention to an interesting spiral movement in the electric fluid, which occasionally takes place in the aurora experiment, which cannot be accounted for. We think it may possibly have some connexion with a fact which we noticed, that, although the apparatus is not shifted at all, yet the discharges do not take place in the same spot, but are always shifting: it may be, because the electricity does not arrive at the same degree of tension on the spot where a discharge has just taken place.

[1] On closely inspecting the paper on which the metals were exploded, which was kindly given to us by Mr. Bachhoffner, the coloured streaks which are left were found, in several instances, to be composed of an infinite series of finer lines, placed at right angles to the general streak, showing that at the time of the discharge they were converted into temporary electro-magnets.

We think the proprietors of the Polytechnic Institution deserve all the success they are reaping, for the spirited way in which they are bringing forward all new scientific discoveries; and may, with great confidence, recommend our readers, both scientific and otherwise, to witness the splendid effects of this new machine.

PREPARED PAINTED SURFACES OF PAPER.

HENRY MARTIN, of Norton-terrace, Camden-town, painter, has obtained a patent for "*improvements in preparing surfaces of paper.*—Patent dated March 30, 1840; they consist in embossing and enamelling the surfaces of paper, and in manufacturing paper-hangings. A coat of oil-paint of the desired colour, is first applied to the surface of the paper, as evenly as possible, with a common paint-brush; it is then rubbed lightly over with a brush, similar to a clothes or shoe-brush, (giving it a circular motion,) to remove the marks of the paint-brush; after which, an additional smoothness is given to the painted surface, by passing a dry brush, called a "a softener," lightly over it. If more than one coat of paint be laid on, this process is repeated. Or, instead of the above method, the paint may be applied by conducting the paper between two rollers, together with an endless felt or other fabric, which is supplied with paint by passing under a roller, partly immersed in it; the superfluous paint being removed from the felt, as it ascends, by a scraper. The paper, thus prepared, is embossed, by passing it between engraved rollers or dies; or is converted into paper-hangings, by printing the required designs upon it with blocks or other surfaces. If a glazed or enamelled surface is to be given to the paper, the oil-paint must be used in a thick or round state, and thinned only with turpentine, in the same manner as if it were used for "flatting." When the turpentine evaporates, the colour becomes set; the paper is then placed upon a bed of woollen cloth or other soft material, and a pallet-knife or trowel, with a polished surface, is passed over the painted surface of the paper, with a slight pressure; the colour being set, yields to the pressure, and a glaze is thereby produced, which may be afterwards heightened in the usual manner. Other means may be resorted to for glazing the painted surface of the paper, if preferred.

RAILWAY CHRONICLE OF THE MONTH.

THE Railway proceedings of this month have been principally confined to the results of the great amalgamation movement of last month. The influence of the Great Midland junction has been to produce the greatest effect on all the railway interests of England by the creation of a new power, with a new policy. The London and Birmingham, hitherto the ruling line of the south, has been the first to feel the change. It is said that the Great Midland has made a proposition requiring the London and Birmingham to let them work their own traffic to London on the same terms as the Manchester and Birmingham do on the Grand Junction, under the penalty of having their own line from Leicester to London. The London and Birmingham have, in consequence, taken a bold step by bringing about an amalgamation, or rather union, of the Northern and Eastern and Eastern Counties, so as to prevent these latter lines from falling under the power of the Great Midland, and assisting them in obtaining the traffic of the north and east of England; while it is expected this measure will secure to the London aud Birmingham the benefits of the Northampton and Peterborough line. It is most probable that these hopes of the London and Birmingham will not be fulfilled; but the union of the two lines has taken place, meeting of each being held at the Shoreditch Station on the 25th, when resolutions were passed, almost without opposition, approving of the plan, except that Mr. D. W. Harvey, at the Eastern Counties' meeting, made a speech two hours long. The plan guarantees 5 per cent. dividend to the Northern and Eastern, then the Eastern Counties to have 4½ per cent., and the remaining profits to be divided in the proportion of two-thirds to the Eastern Counties, and one-third to the Northern and Eastern. The joint board to consist of twelve Eastern Counties' Directors and six Northern and Eastern Directors.

The Devon and Cornwall Railway is progressing, two meetings having been held at Plymouth and Devonport on the 25th and 26th, in favour of it, at which Mr. Saunders, secretary and chief superintendent, and Mr. Brunel, chief engineer of the Great Western Railway, attended.

Two lines have been started as branches from the Eastern Counties Railway to Harwich, and the plan for the extension to Ipswich is being prosecuted.

A line has been brought forward to carry the mineral traffic in Furness for shipment to the Piel of Foudrey: it will also form part of a West Cumberland line.

The Churnet Valley line has been revived. This railway would proceed from the Manchester and Birmingham Railway by Leeds to Derby.

Mr. Rastrick is surveying for a Brighton Railway branch from Shoreham to Worthing and Chichester.

We ought to have mentioned above that an amalgamation is also on the *tapis* between the North Union Railway and the Bolton and Preston. Many parties justly fear that the ultimate result of amalgamation will be to throw all the lines into the hands of the Government. The French government, in defiance of the expression of public feeling on the General Railway Act, is trying to get the lines into its own hand in France. It is said they intend next session to ask the Chambers for her authority to work the Paris and Northern Railway and Montpellier and Nismes Railway. This, if successful, would also be an example for our parties here.

With regard to foreign railways, the great event has been the opening of the junction line between Liege and Aix-la-Chapelle. This forms a continuous communication of upwards of 200 miles from Cologne, on the Rhine, to Antwerp, Ostend, and Lille.

The Darlington Junction Railway has guaranteed the projectors of the High Level Bridge 3 per cent. on the expenditure of £100,000, as a composition for toll on railway traffic. Messrs. John and Benjamin Green are appointed architects, and Robert Stephenson consulting engineer. The idea of employing wood is abandoned, and either stone or wood will be the material employed. The capital is to be raised in shares of 20*l.* each, and the estimate of the cost of the bridge is £80,000; a revenue from traffic of 8½ per cent in addition to the guaranteed per centage is anticipated, notwithstanding which, very few shares have been taken; the prospectus was issued last September, and John Hodgson Hinde, Esq., M.P., is chairman of the committee.

Another great event of the month, has been the decision in the important case in Chancery of Ranger *v. The Great Western Railway*, involving in itself and the cases depending upon it, upwards of a quarter of a million sterling, some say £400,000. This litigation has long acted to the disadvantage of the Great Western Railway Company, Mr. Ranger and his advocates having been large in their demands and loud in their denunciations of fraud against the company and its engineers, particularly Mr. Brunel's. The Vice Chancellor of England, Sir Lancelot Shadwell, in giving judgment by special appointment, at Lincoln's Inn on the 27th, gave judgment on every point in favour of the company, dismissing the plaintiff's bill with costs, and declaring his statements to be devoid of foundation, at the same time that he vindicated the high character of Messrs. Brunel, Frere, and Babbage. As to the plea that contractors were not to be guided by the decision of the engineer as to the mode in which the work was executed, the Vice-Chancellor repudiated such a doctrine; he said it was of importance to the safety of mankind that railways should be executed under the directions of eminently scientific men, and that in the act of the Great Western Railway Company, the legislature had set an example, in declaring the opinion of the Surveyor General of Metropolitan Roads, and of the Engineer of the London and Birmingham Railway, decisive as to certain works, as to quantities and valuations, however application might be made to that court. He treated as nonsense the attempt to reject the decision of the engineer, because he was a shareholder in the company; it was notorious that engineers and other officers of railway companys were shareholders in them: and there could be no doubt the interest of the engineer was paramount to that of the shareholder. The Vice-Chancellor, on the plaintiff's own showing, upheld the system of penalties for the fulfilment of a contract, as a wholesome system to insure the work being effectually and punctually executed, since the plaintiff himself had adopted the same system with his subcontractors, and on the same gronnds. He also asserted the legality of the taking possession of the work and plant. In fine, the Vice-Chancellor dismissed the bill on nearly every ground, with costs, leaving the plaintiff to any remedy he might have at common law, and allowing an account to be made out subject to the penalties and conditions of the contract. This result was what was anticipated by most reasonable men, though Mr. Ranger and his friends had buoyed themselves up to the last with the hopes of success. He will, however, very probably try to induce his creditors to appeal from this judgment, though it is not likely with any success. This decision is of importance, not merely on its technical grounds, but as it relieves the property of the Great Western Company from a *bearing* influence in the money market, secures the present management in office, which otherwise was in jeopardy, and leaves free scope for the exercise of the plans of extension entertained by the moving parties in the concern.

Midland Counties Railway.—We are informed that the platform across the Trent was not carried away by the floods, as stated in last month's *Journal*, but was removed at the latter end of August, in consequence of the Weir being finished.

ENGLISH AND BELGIAN COKE.—For the comfort of the Newcastle coal-owners, and as a set-off to a paragraph deprecatory of the Newcastle coal, we have to mention that serious complaints have been made by all parties connected with the Paris and Rouen Railway, in reference to the Belgian coke which has been latterly used upon it. The *Journal of Rouen*, states in a recent number, that on the opening of the railway, and for some time afterwards, the locomotives were supplied with English coke, and all went well. The stock, however, became exhausted, and recourse was had to Belgian coke. The trains immediately became seriously retarded, and the company has appealed to the Tribune of Commerce, for damages against the merchant who supplied the Belgian coke—and surveyors have been appointed, in consequence, to estimate the damage.—*Gateshead Observer.*

THE GREAT NORTHERN STEAM SHIP.

This fine vessel, which was built by two or three spirited individuals at Londonderry, in the north of Ireland, and completed last year, arrived in the river Thames last January, she has since then, through some imperfection in her machinery, been laid up in the East India Docks, for the purpose of having her engines thoroughly examined and set to rights, to adapt them more particularly to the working of Mr. Smith's patent Archimedean screw; for this purpose, the owners placed the machinery in the hands of Messrs. Miller and Ravenhill, the well known engineers of Blackwall. We know of no one better qualified for such a task than Mr. Joseph Miller, his superior practical knowledge of all the details of the marine engine are well known to all persons throughout the world, who are in any way connected with steam navigation; this is farther proved by the very great satisfaction he has given to the owners, for the very perfect manner he has completed his task, which has been an Herculean one, when it is considered that he has had to alter engines of a large magnitude which had been made, not by one engineer, but by several, and in various parts of the United Kingd m, part having been made in Ireland, and other parts by different manufacturers in England. It now affords us much pleasure to say that at a trial of the vessel down the river Thames on the 11th ult., the engines performed all that could be desired; her performance against tide was fully equal to 7½ knots per hour, her speed through the water may be fairly taken at 10 knots per hour; when we consider the disproportion of the power to the tonnage of the vessel, this is a most satisfactory performance, and shows that the screw is nearly equal to the paddle wheel in rivers, and superior in the open sea, particularly during tempestuous weather. It must be a source of great satisfaction to Mr. Smith, the patentee, to whom all the credit is due, for his persevering industry in bringing forward this new mode of propelling, in opposition to a whole phalanx of great men.

As the engines have undergone some alterations, we will proceed to describe them, together with their dimensions, and also those of the vessel.

There are two engines, which are placed immediately abaft the vessel, with the large spur wheel athwart, between the engines, and the boilers in advance of the engines, leaving the whole of the midships and fore part of the vessel clear; and we must here suggest the necessity of placing the saloon or principal cabin in the midships, so as to avoid the unpleasant noise of the cog-wheel gearing, which is very objectionable. There cannot be the slightest objection to it; for, if stowage be required, it might be placed in the stern and fore part of the vessel as well as in the midships.

The engines are of the direct action steeple principle, with cylinders 68 in. diameter, and 4 ft. 6 in. stroke placed in the centre of the breadth of the vessel: attached to the top of the piston rod is the cross head, forming the base of a triangle, to the apex of which is depended the connecting rod, working like a pendulum; the lower end of this rod is attached to a crank fixed on to the shaft of the large spur-wheel, a corresponding engine working a similar crank on the other side of the spur-wheel, which is, as before stated, placed between the two engines. There are two air pumps to each engine 19 inches diameter, and of the same stroke as the cylinder, worked by rods fixed at each end of the cross head forming the base of the triangle just mentioned: these two air pumps communicate by passages with a single condenser placed in front of the cylinder, with the steam and exhaust valves between. From this description it will be seen that the power is applied direct to the large spur wheel, 20 feet diameter, (depth of cogs on the face, 23 inches, and pitch, 6 inches,) which takes into a pinion, below 5 feet diameter, fixed on the iron propeller shaft, 10 inches diameter, which is firmly attached to the screw propeller with couplings; the diameter of the screw is 11 ft., length fore and aft 5 ft. 10 in., and pitch 14 ft. From these dimensions it will be seen that, if the engines make 20 strokes per minute, the speed of the screw will be equal to 80 revolutions per minute.

The vessel is of the following dimensions, extreme length 247 ft. breadth of beam 37 ft. length between perpendiculars 222 ft., depth in hold 26 ft. 5 in. draught of water 18 ft., length of main mast 90 ft. foremast 83 ft., mizenmast 61 ft., length of mainyard 76 ft. and diameter 22½ in., she can spread the enormous quantity of 6700 sq. yds. of canvass; burthen B.M. 1750 tons; there are three decks, the upper one is entirely clear, excepting the forecastle, all the windlass and capstan gear being 'twixt decks; she is built remarkably strong, and is in every way a vessel that will stand severe service.

THE IRON STEAM SHIP "NIMROD."

This vessel was launched from the building-yard of Messrs. Thomas Vernon & Co, on 26th Sept. last. The following are the dimensions of the vessel:

Length from figure-head to taffrail..	200 feet.
do. between perpendiculars ..	180 „
do. of keel	175 „
Beam	26 „
Width over Paddle-boxes ..	46 „
Depth of Hold	16 „

and admeasures, old mode, 591 tons. This vessel is built for the City of Cork Steam Packet Company, who intend to sail her between this port and Cork. She being the 30th iron vessel which has been constructed at this establishment, many improvements have been introduced which experience alone can discover: she is adapted to carry a large cargo at a very light draft of water; and by her beautiful lines and model she is possessed of the qualities of an excellent sea-boat and fast sailer. The hull, rudder, paddle-beams, and deck-beams are made entirely of iron, and are of extraordinary strength. She is clinker-built to light water line, and double riveted on the longitudinal joints: above this line the plates are all flush. She has four water-tight bulk-heads, and divided into five water-tight compartments, the absence of which in other vessels has often to be deplored: the Pegasus, Solway, and Queen, which have so lately gone down, would no doubt have been saved had they possessed this improvement. The frames of this vessel are of strong angle iron, with sleepers, 15 inches deep across the bottom; the length of the fore-hold is 50 ft. 10 in. exclusive of a portion at the bow for chain lockers and use of the crew; and length of after-hold, 63 ft. 6 in. between which and the stern-post is placed a tank to contain water. The quarter-deck is 55 ft. long, from which the cabins are entered by a spiral staircase. The principal saloon is 41 ft. long and 8 ft. high; it is ornamented by Bielefeld's papier maché gilded mouldings, and, though not of the most splendid order, presents an appearance exceedingly neat and elegant; it is lighted from the deck by a skylight of considerable size and very chaste design: there is a separate cabin for the ladies, and one for the gentlemen, both neatly fitted up with every convenience for the comfort of passengers. The entrance-hall is pleasant and airy, and the steward's pantry compact and conveniently situated. The number of berths which can be made up is 50. She is intended to have three masts, rigged with Smith's patent wire rope, and is expected to be ready for sea this month. The keel was laid on the 6th of May last, so that the vessel has been built in the short space of four months and twenty days.

The engines, manufactured by Messrs. Bury, Curtis, & Kennedy, are of 300 H. P.; they are on the direct-action plan, with a much longer connecting rod than is generally obtained in direct engines, though they do not reach a greater height above the deck than that of an ordinary crank scuttle; they also occupy a very small portion of the vessel, the length of the engines alone being 9 ft., and width, 20 ft. 6 in., and the whole space occupied in the length of the vessel, including engines, boilers, firing-room, &c., is only 35 ft. 10 in.; the engine-room is thus so much reduced, that the capacity of the holds is increased at least 10,000 cubic feet for stowage above that which is generally obtained when engines of the side lever construction are used. They are of the following dimensions, viz.:

Diameter of cylinders		66 inches.
Length of stroke	5 feet	3 „
Diameter of paddle-wheels over the floats	24 „	6 „
Breadth of paddle-floats	8 „	6 „
Depth of ditto	2 „	7 „

The air-pump, which is double-acting and placed between the cylinders, is 37 in. diameter, and 2 ft. 7 in. stroke.

MISCELLANEA.

New Dock at Ellesmere Port.—A commodious new dock, for the reception of shipping, has just been completed by the Ellesmere and Chester Canal Company at the terminus of their canal at Ellesmere Port. The opening of the dock for public use was celebrated on the 13th Sept. The works occupy three acres, and consist of a spacious dock, with wharfage, berths, &c., capable of accommodating a large number of vessels of 300 tons burthen. In connexion with the dock is an extended range of warehouses, four stories high, being 260 feet in length, and 45 feet wide; and which are connected with the dock by three wings, two stories in height, each extending in length 20 feet, and being 40 feet wide, and under which canals extend from the dock for the convenience of loading and unloading the vessels and boats using the canal and dock. The whole of the works, with the exception of the river wall, were designed by the late eminent engineer, Thomas Telford, Esq., F.R.S., whose plans have been carried out under the direction of Mr. Cubitt. The works, which have been in progress for the last two or three years, were conducted under the able direction of Mr. Provis, the contractor, at a cost of £100,000, and are a masterpiece of architectural and engineering skill.

The *National* states that the Government had commenced the construction of buildings near Vincennes which would cover beyond 300 acres of ground, and were intended to contain a model foundry and complete arsenals, with barracks for a considerable force of infantry and cavalry. "These works," adds the *National*, "have been undertaken without the authority of the Chambers, and the expense of the construction is estimated at 45.000,000f."

Cornwall.—The Town Council of Truro have selected the designs of Messrs. Cope and Eales of Bloomsbury Square, for the New Stannaries Hall, Town Hall and Markets about to be erected there. There are two façades in the Italian style of architecture, one facing the river and forming an approach to the Fish Market. The buildings are to be executed in Granite at a cost of about £7000. The second premium was awarded to Mr. E. W. Elmslie of Carlton Chambers. The Town Hall and Markets at St. Anstell, also designed by Messrs. Cope and Eales, are rapidly pr gressing, and will probably be completed by the ensuing spring.

MR. STEWARD'S NEW IRON BEACON FOR THE GOODWIN.—Her Majesty's steamer *Tartarus*, Captain Bullock, R.N., arrived in our roads on Saturday last for the purpose of taking off and planting on the Goodwin Sands an iron beacon invented by Mr. Steward, and constructed upon the principle of the ponderous-footed pile, which is the great novelty in Mr. Steward's plan for the formation of a harbour of refuge. On Sunday afternoon Captain Bullock having communicated with Mr. Steward as to the best course of proceeding, the *Tartarus* sailed for the Goodwin, to fix a buoy at the spot appointed by the Hon. Trinity Board for the erection of the beacon. On Monday the *Tartarus* returned to our bay, having been prevented by the heavy surf on the Goodwin from fixing the buoy. After a stay of a few hours the *Tartarus* again steamed off for the Goodwin, and returned to Dover on Tuesday morning, accompanied by the large lugger No. 1, from the deal yard, to take off the beacon. For this purpose the *Tartarus*, having upon each visit received the usual flag honours from the castle and heights, entered the harbour, and being a very fine vessel, upwards of 500 tons, she was an object of no small attraction. On Wednesday morning, arrangements having been made for shipping the beacon on board the lugger, half of the shaft, with the ponderous foot, was lowered from the Ordnance crane, when it was unfortunately found that the boat was unequal to the weight of this part of the beacon, on account of the position in which it was necessary to place it. It was then considered the best plan to procure from Sheerness a chain lighter, and the *Tartarus* left the harbour on Wednesday afternoon, and proceeded to Sheerness for that purpose. She is expected to return in a few days to complete her task, and place Mr. Steward's beacon on that grave of thousands, the all-devouring Goodwin. May success attend the indefatigable exertions of the worthy inventor! The beacon was cast by Messrs. Poole and Co., of this town, and we shall give a description of it in a future number. The active co-operation of the Admiralty must be highly gratifying to Mr. Steward, as it ought also to be to the public in general, evidencing, as it does, the readiness of the Government to promote all plans of merit projected for the safe guidance of the wooden walls of old England, and the preservation of their brave crews.—*Dover Telegraph.*

IMPROVEMENT OF THE RIVER TYNE.—The Town Council of Newcastle on October 11th. decided to take the opinion of Mr. J. Walker, as to the effect of the alterations now in progress in contracting the waterway to a line laid down by the late Mr. Rennie, in which line Mr. Cubitt, Mr. Richardson, and Mr. Anderson, the late engineer to the corporation, and their present engineer, Mr. Brooks, are said to concur. The opinion of Mr. Walker is taken, as engineer to the admiralty, in consequence of a memorial from the Trinity House, shipowners, and pilots, to the Council, against the proposed contraction of the river at Dent's Hole; Mr. Cubitt having been previously employed as consulting engineer to the Corporation, it was proposed to consult him as to the contraction at Dent's Hole; but Mr. Walker's opinion as to the whole question was decided to be taken.

LAUNCH OF AN IRON STEAM-VESSEL.—On the 5th ult. there was launched from the yard of Messrs. Fairbairn & Co , of Millwall, a beautiful iron steam-vessel called *Der Pfalz Graf*, of the following dimensions—length, 180 ft., beam, 20 ft. 3 in., depth of hold, 9 ft., and about 350 tons burthen, to be propelled by engines equal to 160 H. P. Her draught of warer when launched was only 20 inches upon an even keel; and with all her machinery, boilers, and fuel on board, it will not exceed three feet She is intended for the navigation of the River Rhine, and will be employed as a tug-boat for taking up vessels from Rotterdam as high as Strasburg. *Der Pfalz Graf* is the latest of three steamers that have been constructed by the Messrs. Fairbairn, to be used as towing vessels on the same river; and we are informed that the former two, which were of nearly equal dimensions with the present one, have completely answered the expectations of the proprietors.

LAUNCH OF THE "FIRE QUEEN."—On Tuesday, September 26th, a splendid new iron steamer, called the *Fire Queen*, was launched from the yard of Messrs. Davenport, Grindrod, and Patrick, south side of the Queen's Basin, Liverpool. The vessel, which is intended to carry passengers and cargo between Calcutta and Singapore, is about 500 tons burthen, and will have engines of about 200 H.P.

ENGLISH LOCOMOTIVE ENGINES ON THE CONTINENT.—In Germany (exclusive of Austria) there are running 180 locomotive engines, built in England, of which Messrs. Robert Stephenson & Co. made 81, running on 14 lines of railway; Sharp & Co. made 49, running on 10 lines of railway; Turner & Co., 11; Rothwell, 10; Longridge & Co., 5; Forrester & Co., 5; Kirtly, 5; Tayleur & Co., 1; Bury & Co., 4; Fenton & Co., 2; Gaskell, 2; Rennie, 1; Hawthorn, 1.—Total, 180.—*Leipsic Journal.*

North Shields.—A new gas company, to be called the Borough of Tynemouth, was formed last October, with a capital of £6000, in shares of 5*l*. each, and in two hours a thousand shares were taken up, the old company refusing to light the town on the terms offered by the Commissioners, viz., 45*s*. per lamp per annum.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM SEPTEMBER 26 TO OCTOBER 21, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

Elisha Haydon Collier, of Goldsworthy-terrace, Rotherhithe, Surrey, civil engineer, for "*improvements in the construction of furnaces and flues.*."—Sealed September 28.

John Ainslie Farmer, of Redhaugh, near Dalkeith, N. B., for "*a new or improved mode of drying tiles, bricks, retorts, and such like work, made from clay and other plastic substances.*"—Sept. 30.

John George Briggs, of Leicester, coach proprietor, for "*improvements in axles.*"—Oct. 5.

Edward Banton, of Walsall, Stafford, saddlers' ironmonger, for "*improvements in saddles and horse harness.*"—Oct. 5.

Richard Boote, of Burslem, Stafford, earthenware manufacturer's clerk, for "*improvements in pottery and mosaic work.*"—October 5.

Benedict Albano, of Piccadilly, civil engineer, for "*improvements in preparing materials, and applying them to the manufacture of ornamental mouldings, and other useful purposes.*" (A communication.)—Oct. 5.

James Combe, of Leeds, engineer, for "*improvements in heckling, cleaning, preparing, and carding flax and other fibrous substances.*"—Oct. 5.

Ferdinand Charles Warlich, of Cecil-street, gentleman, for "*improvements in the manufacture of fuel.*"—Oct. 5.

William North, of Stangate, Surrey, slater, for "*improvements in covering roofs and flats of buildings with slate.*"—Oct. 5.

Jonathan Saunders, of Soho Hill, Birmingham, gentleman, for "*improvements in the manufacture of tyres of railway and other wheels, and in the manufacture of railway and other axles.*"—Oct. 5.

James Griffin, of Withymoore works, Dudley, manufacturer, for "*improvements in the manufacture of spades, shovels, and such like tools.*"—Oct. 5.

John Baptist Soldi, of Windsor-place, Southwark-bridge-road, Surrey, for "*improvements in apparatus for measuring of person's heads, and for fitting and retaining hats, caps, and bonnets according to such measure.*" (A communication.)—Oct. 5.

Charles Brown, of Woolwich, Kent, surgeon, for "*improvements in the manufacture of dip candles.*"—October 5.

Lawrence Hardman, of Liverpool, merchant, for "*improvements in machinery or apparatus to be employed in the manufacture of sugar.*"—Oct. 5.

John George Bodmer, of Manchester, engineer, for "*improvements in grates, furnaces, and boilers, and also in manufacturing or working iron or other metals, and in machinery connected therewith.*"—Oct. 5.

Margaret Henrietta Marshall, of Manchester, for "*an improved plastic composition, applicable to the fine arts, and to useful and ornamental purposes.*"—Oct. 5.

George Wall, jun., of Manchester, gentleman, for "*improvements in the methods or processes of manufacturing earthenware, china, and other similar substances, and also in the machinery or apparatus applicable to such manufactures.*"—October 5.

Philip Walther, of Angel-court, Throgmorton-street, merchant, for "*improvements iu the construction of steam-engines.*" A communication.—Oct. 12.

John Cleaver, of Ripley, spelter maker, for "*an improved furnace for subliming or reducing to a metallic state the ores of zinc.*"—Oct. 12; two months.

Stephen Hutchinson, of the London gas works, Vauxhall, engineer, for "*improvements in gas meters.*"—Oct. 12.

Charles Brook, of Waltham mills, cotton spinner, for "*improvements in machinery for spinning and twisting cotton and other fibrous substances.*"—Oct. 12.

Moses Poole, of Serle-street, gentleman, for "*improvements in enveloping medicine.*" (A communication.)—Oct. 12.

Stephen Geary, of Hamilton-place, King's-cross, architect and civil engineer, tor "*improvements in the construction of panelling and framing, applicable to all building purposes, cabinet work, and other similar uses.*"—Oct. 13.

Richard Beard, of Egremont-place, New-road, Middlesex, gentleman, for "*improvements in printing calicoes and other fabrics.*" (A communication.)—October 13.

Richard Tanion Nevill, of Llangennech, Carmarthen, Esq., for "*an improved mode of separating certain metals when in certain states of combination with each other.*"—October 18.

William Watson, Junior, of Leeds, chemist, for "*improvements in ventilating houses and other buildings.*"—October 18.

Jnlius Adolph Detmold, of London, merchant, for "*improvements in the construction and arrangement of furnaces or fire-places applicable to various useful purposes.*"—Oct. 18.

James Graham, of Wapping, Middlesex, for "*improvements in the construction of pots or vessels, and furnaces used in the manufacture of zink, and in other manufactures, and also improvements in the treatment of the ores of zink in the process of manufacturing zink.*"—Oct. 8.

Thomas Morton Jones, of Birmingham, merchant, for "*improvements in heating liquids and aeriform bodies.*"—October 18.

James Gibbons, of New Radford, Nottingham, machinist, and Thomas Roe, of the same place, machinist, for "*improvements in machinery used for what is called setting or reading patterns, and stamping or punching them in jacquard cards.*"—Oct. 21.

George Edward Mylne, of Albion-terrace, Canonbury-square, Islington, watchmaker, for "*improvements in the construction of watches.*"—Oct. 21.

ERRATA IN LAST MONTH'S JOURNAL.

Page 356, column 1, line 6, for "*challenged*" read "*alleged.*"

Page 366, column 2, the *Princess Alice* steamer, for "12 feet long" read "120 feet long;" and in the fifth line from bottom, for "*this*" read "*these.*"